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Japan Report

(FOUO 3/82)

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MILITARY

U.S. INTEREST IN JAPAN'S MILITARY BUILDUP CONSIDERED LIMITED

Tokyo ASAHI JANARU in Japanese 30 Oct 81 pp 34-38

[Article by Ohtake Hideo, assistant professor of political science, Tohoku University: "Detente to Military Expansion"]

[Excerpt] With the strengthening of NATO came a full-fledged demand that Japan increase its defense forces. But with regard to the military buildup of Japan, the problem is not as simple as that of Western Europe. This is because of the lingering fear that Japan will again become a military power. It can be said that America's policy of military alliance (excluding the human rights diplomacy of the early years of the Carter administration) is based on a principle that differs depending on whether a dictatorial government is leaning to the left or the right. Furthermore, it is based on the assumption that whereas leftist dictatorial nations (communists) can be a great threat to the security of the United States, rightist dictatorial nations (military dictatorship or fascism), even though undeniably their policy of internal control contradicts the American philosophy, do not at least pose any direct threat to its security.

If we follow this line of thought, Japan's existence is unique to America, insofar as it is believed that it can easily shift to the right and thus become a military state that can threaten the United States. The one-sidedness of the Japan-U.S. Security Treaty, which is uniquely different from military treaties the United States has with other countries such as Korea and Taiwan, is nothing more than an expression of the special way in which Japan is viewed by the United States. Therefore, in order to demand military cooperation from Japan beyond a certain limit, the United States needs the assurance that there is no danger (or that the danger is minimal) that Japan will become a military state. Japan, through its economic growth, has become a potential military power. Because of this, from the mid-seventies America's defense policy with regard to Japan began to falter. An important factor in this lay in America's uncertainty about Japan's move toward militarism.

In the seventies there were at least two occasions in which American defense specialists expressed concern about a Japanese trend toward becoming a military power. The first occasion was in the early seventies, when the so-called "Theory of Autonomous Defense" and Fourth Term Defense Planning appeared. During this period, the Japanese political elite, whenever occasion demanded, provided detailed explanations of the concept of "domestic control" (national sentiment, Article 9

of the constitution) and exchanged criticism on this resurgence of militarism. This topic has already been discussed in detail in this series and will not be repeated here: we note only the irony that such arguments not only had the effect, but also contrarily, of establishing a basis upon which Japan could be asked to strengthen its military "without any worry." Furthermore, it was also during this period that the Defense Agency repeatedly offered explanations as to how ill-prepared and how far removed its military was from making Japan a powerful military nation. It should be noted that this resulted in the contrary effect of making the U.S. Department of State and military request extremely concrete improvements on the part of the Japanese military.

Fear of Japanese Militarism Rekindled

After the early seventies controversy over resurgence of Japanese militarism had quieted down, concern over Japan's move toward the same (more accurately, Japan's "independence from America") resurfaced during the Miki administration. It may be that this debate was used politically to counter those in the Congress who advocated American "withdrawal from Asia." However, because Japan at that time was extremely cautious about ratifying the nuclear defense treaty, it is a fact that the U.S. Government was actually concerned about the possibility of Japan arming itself with nuclear weapons. At this time, with the withdrawal of American forces from Vietnam and the fall of Saigon, there emerged, among the hawkish faction in Japan, a sense of danger regarding America's pullout from Asia. At the same time, due to the Soviet Union achieving nuclear balance with the United States, there was a widespread conviction that the reliability of America's nuclear umbrella had deteriorated radically. Especially among the hawkish Liberal Democrats in the House of Councilors, such as Minoru Genda and Masao Miyazaki, there were those who, in order to have a "free hand" in nuclear weapons, advocated that the nuclear defense treaty should not be ratified or that Japan should be reassured of America's defense of Japan in return for the ratification. In the evenly matched House of Councilors, the few hawkish members held "deciding votes" and greatly influenced the nuclear policy of the Miki cabinet. It is believed that the United States, unable to understand fully this peculiar power struggle within Japan, was fearful that Japan might move in the direction of nuclear weapons.

But this fear was eliminated by the following two methods. First, with the ratification of the nuclear defense treaty, an inspection system was also introduced in Japan and, furthermore, during the Carter administration, the United States was able to take an even more severe stance with regard to nuclear proliferation, and measures were set up to control the supply of nuclear fuel. Because of this, a system was created whereby Japan's move toward nuclear armament could be checked. Second, with the consolidation of a structure of strategic cooperation between the two countries, which was begun by Handa, head of the Defense Agency, the U.S. military was guaranteed almost free access to the information held by the Defense Agency. This made it possible for the United States to check even the slightest move that Japan might take in the direction of military buildup.

These systems were created without any significant debate, but, in fact, could be said to have greatly influenced the subsequent military relationship between Japan and the United States. In a word, what these two systems did to the Japanese Self-Defense Forces was similar to the results of restrictions created by the

internationally unified command network called NATO, which was assigned the task of controlling West Germany's resurgence as a military power. Through these two systems the United States was able to prevent Japan's independent move toward militarism and could demand that Japan strengthen its military forces without the fear of Japan moving in that direction. It is in this respect that the systems prepared the way later for America's demand that Japan increase its military strength.

In any case, America's transition in the seventies from a policy of detente to that of military expansion was completed by 1978. Overlapping with this was the criticisim of a "free ride" voiced against Japan in the Congress. In the spring of 1978, the demand on Japan first appeared concretely in the form of a request that Japan shoulder a portion of the expenses required to maintain American forces in Japan. Since then, the United States has repeatedly asked Japan to increase its share of defense in various forms. The contents of these requests and Japanese responses to them will be discussed beginning with the next series. Here, in conclusion, I would like to comment on the question of what position these American demands on Japan occupy in that country's total defense structure.

What needs to be pointed out here is that, throughout the seventies, U.S. defense experts, from the President to the White House staff and Pentagon officials, showed only limited interest in Japan. This fact has remained basically unchanged from the end of the seventies, when the United States began to demand strongly that Japan strengthen its military, into the eighties. Despite straightforward demands that have often had the appearance of interfering in the internal affairs of Japan, the manner in which the United States has made demands on Japan has lacked any consistency. America's style is still one of applying pressure when and if it recalls that pressure is needed. An example of this is the fact that, at present, the Reagan administration, preoccupied with economic problems and with Soviet expansionism, is silent about making demands on Japan.

The reason is that there is a consensus among U.S. officials that the Far East, in comparision with other areas, is relatively stable. The troubled areas include the Persian Gulf, Central and South Africa, and Southeast Asia (Iran-Iraq War, Israeli issue, Angola War, Ethiopian problem, Cambodian problem, China-Vietnam War); in Central Europe, there is the confrontation with the Soviets (deployment of strategic nuclear weapons, strengthening of NATO, etc), and the nuclear race and limitation talks also with the Soviets. When the Far East is viewed in comparison with these serious problems that confront the United States, the view that the Far East is relatively stable is quite justifiable.

With regard to the military buildup of the Soviet Union, as far as Japan is concerned, its army is offset by the existence of China, and as for its navy, even though it may be effective in checking the U.S. Seventh Fleet from entering the Persian Gulf, it poses no direct threat to Japan. Thus, the United States, on account of Japan's economic prosperity and political stability, and because of the U.S.-China "military alliance" against the Soviet Union, views the Far East as being militarily stable.

Case-by-Case U.S. Demands on Japan To Increase Its Military Strength

It is not an exaggeration to say that America directs its attention to Japan when it wants to reduce its military strength in the Far East so it can increase elsewhere. The military situation in and around Japan is studied as a part of U.S.

global military strategy; even in the so-called "second cold war" following the Afghanistan crisis, the United States is not really interested in the military situation in the vicinity of Japan. Of course, there is the undercurrent of dissatisfaction flowing through the American political scene that Japan is "getting a free ride," and such a feeling surfaces abruptly from time to time. However, as long as the Far East is considered militarily stable, there will not be a continuous U.S. military interest in Japan. Consequently, the U.S. military demands on Japan, from the perspective of security, differ radically from those made on other countries and have never followed a consistent course. In other words, its demands have been made case by case: if a demand is not met, it retreats, saying it couldn't be helped; if met, it considers itself lucky. This is the kind of nuance [as published] that characterizes its actions, and from which it has yet to extricate itself.

However, the Japanese media, through its sensationalims, has exaggerated the U.S. understanding of the threat in the Far East regarding its demands on Japan and, along with the Foreign Ministry, the Defense Agnecy, and the hawkish rightist Liberal Democrats, has created excessive responses to America's demands. Naturally, it cannot be denied that there is a strong dissatisfaction, principally within Congress, with Japan's economic policy and that this, frequently in conjunction with the defense problems, has made things extremely serious between the two countries. However, it is the view of this writer that, insofar as defense policy is concerned, it is a mistake to think that the demands which the United States has made on Japan occupy such a significant position within the total defense structure of that country.

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ECONOMIC

ANNUAL REPORT: FISCAL 1981 WHITE PAPER

Tokyo TECHNOCRAT in English Vol 14 No 9, Sept 81 pp 29-46

[Summary of the Annual Report of the Economy, Economic Planning Agency]

[Text]

The Economic Planning Agency has published the "Annual Report of the Economy—Fiscal 1981"(Economic White Paper), which had been approved by the cabinet in a meeting held on August 14, 1981. The White Paper highly appraises the satisfactory performance (economic results) of the Japanese economy in fiscal 1980 which, it says, surmounted the prodigious adverse effects of the 2nd oil crisis by enhancing the vitality of the private sector and by implementing appropriate financial, monetary and price policies. In addition to the vitality to learn, which has been the principle motivation enabling Japan to enter the ranks of the advanced countries, and the creative vitality, the White Paper emphasizes that Japan should tackle the following problems:

(1) Maintain and promote the vitality of the private sector.
(2) Build up an efficient and impartial public sector.
(3) Protect free trade and enliven the world's economy as well as Japan's.
(4) Improve national life—which results from, and is the fountainhead of economic vitality – particularly better housing and greater leisure time.

Given below is a partial translation of the official summary of the Annual Report of the Economy – Fiscal 1981. The summary was published on the same day the Economic White Paper was issued.

(..... indicates skipped passages.)

Part 1. The Japanese Economy during the Period 1980 – 1981

Introduction: The Trend of the Japanese Economy from 1980 to 1981 and Factors which Formulated the Characteristics of the Trend

Fiscal 1980 was the year for the Japanese economy when the adverse economic conditions finally bottomed out from

the second oil crisis. The deterioration seen in such areas as the balance of payments current account and prices, that had been hard hit by the crisis, came to a halt and the "symptoms of economic recession" were eliminated.

The Japanese economy in FY1980 can be summarized in the following three points:

First of all, the effects that the second oil crisis brought about were conspicuous from the standpoint of the level of deterioration in the terms of trade that came from the increased oil prices. In fact, the deterioration in the terms of trade resulted in a sharp decline in the rate of increase of real incomes, causing an appreciable gap between the real economic growth rate and the real national income growth rate.

Secondly, however, the level of performance of the Japanese economy proved to be satisfactory despite all of the effects from the sudden oil price hikes. This is clear in terms of a comparison with the situation in the advanced western countries and also with that at the time of the first oil crisis. Specifically, the Japanese economy, which depends on oil imports more than any other western country, should have suffered more than those countries in its international balance of payments and prices. However, Japan's international balance of payments deficit, which peaked in the last quarter (January–March) of FY1980 (approx. $U.S.5,000 million), showed a quick improvement, and, in FY1981, it began to show a slight surplus. Furthermore, as regards the price situation, the rate of price increases turned out to be the lowest among all the major industrialized nations, as wholesale prices remained nearly unchanged and consumer prices were up only four percent in the second quarter of calendar year 1981 (April–June). This was due primarily to the fact that the effects of the import product price hikes did not cause home made inflation. Meanwhile, real gross national product also showed a steady rise. In the January–March period in 1981, it rose 3.5% over the same period of the previous year, a higher growth rate than that of other major advanced countries.

Also, even as compared with the economy during the first oil crisis, its performance at this time is apparently better. This means that, except the fact that deficits in the balance of payments current account reached an appreciable level at the time of the peak, because of the relative increase in the amount of oil imports in total imports, the effects from the worsened terms of trade turned out to be slight in all areas of the economy.

Thirdly, although the abovementioned effects were relatively small, it cannot be denied that signs of an economic setback were seen in the 1980 economy. These signs were basically the phenomena that arose from process whereby the effect of the deteriorated terms of trade was gradually permeating the domestic economy. The characteristics of the adverse economic symptoms at this time were that economic performance varied in every sector of the economy and was not uniform. Breaking down the economic sectors of final demand, for example, while a favorable performance was seen in plant

and equipment investment and exports, housing construction was stagnant. By industry, a contrast was seen in the performance between the processing industries and the material producing industries, of which the former fared well while the latter showed a sluggish trend. In this situation, meanwhile, inventory adjustment for the material producing industries progressed. By size of businesses, further, the economic setback to medium- and small-sized enterprises was greater than expected. It should also be pointed out that economic conditions varied in each district due to the unusual weather.

In Part 1, the abovementioned general synopsis of the Japanese economy in FY1980 is further broken down, for deeper analysis.

Chapter 1. Effects of the Second Oil Crisis and Its Terminating Process in the Japanese Economy

As a result of the sharp oil price increases from the end of 1978 to 1980, the Japanese economy experienced once again deterioration in its terms of trade and a significant decline in real income. Subsequently, it saw a stagnant trend in domestic final demand and a need for inventory adjustment. Along with these came a slowing down in the pace of economic expansion, the so-called "symptoms of economic recession", starting in the spring of 1980 through to the beginning of 1981.

Meanwhile, the previously worsening terms of trade came nearly to a halt and began to stabilize in and after the Spring of 1980.

Section 1. Terms of Trade and Real Income Trends

Reflecting the sharp increase in oil prices and the movement of the exchange rate, imported product prices showed an increase of 99% in the six quarters in and after the October–December quarter of 1978. This means that the price increase for imported products was higher than that in the same length of time from the October–December quarter in 1973 when it was up 56% after the first oil crisis occurred. Export product prices this time, on the other hand, showed an increase nearly equivalent to that of the previous crisis.

Consequently, the terms of trade (exports deflator/imports deflator) were down approx. 33% this time compared with a decrease of approx. 20% in the previous case.

This decline in the terms of trade conditions, which brought forth a transfer of real purchasing power to the oil exporting countries, reduced the real income (nominal gross national income/domestic demand deflator) of the Japanese economy as a whole.

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Section 2. Final Demand Resulting in a Slight Deterioration in Growth Rate and Small Inventory Adjustment

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Reflecting such sluggish trends in real income, domestic final demand also declined, starting in the latter half of 1979, and resulted in only a small overall increase in 1980.

It is important to note, however, that the deterioration in the terms of trade caused by the oil price increase does not necessarily directly lead up to deflationary effects, because there are some other factors that may offset the tendency for a decline in the growth of domestic final demand. First of all, for example, exports increased. The oil producing countries expanded their imports from Japan and other exports also increased, reflecting the strengthened international competitiveness in export prices due to the deteriorated yen value as seen after the first oil crisis. Secondly, investment in energy-saving areas increased also reflecting the oil price hike.

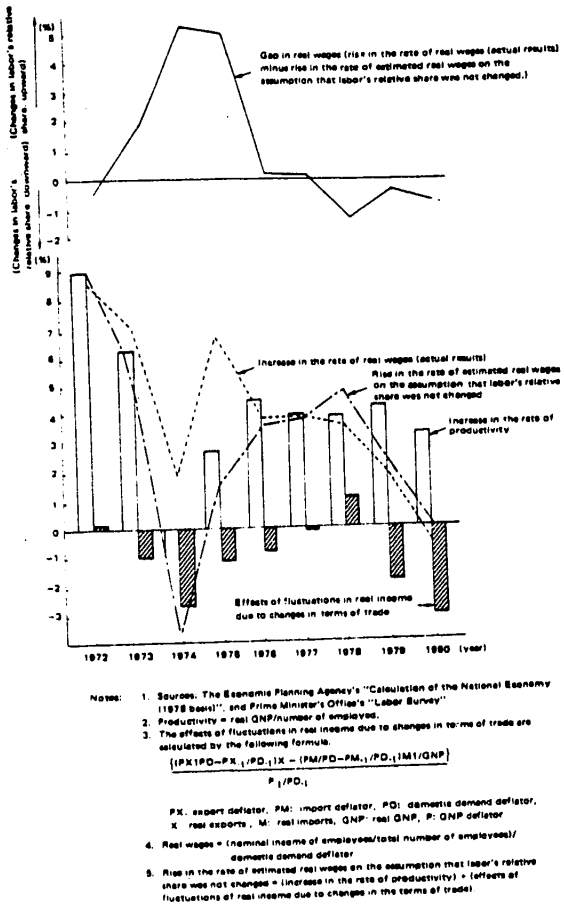
The increase in exports, however, which was also seen in the first oil crisis, does not serve as a major factor that can account for the situational difference between the first and second oil crises. Nonetheless, comparing the effects of the first oil crisis with those of the second, a difference is seen in the conditions of domestic demand.

First of all, all private demand sectors experienced similar declines in their rate of growth in the case of the first crisis, while plant and equipment investment continued to rise this time. Secondly, regarding the other sectors, the rate of decline was smaller this time. In particular, it is noteworthy that the rate of growth of consumption showed a small decline. This is because, although the decrease in real incomes was larger this time, a fall in the propensity to consume did not occur, as had been the case in the previous crisis. Thirdly,the extent of fluctuation in inventory investment this time was smaller than last time.

As for the reasons for the difference in domestic demand conditions between the two periods, which will be further discussed later in more detail, it may be macroscopically summarized in the following three points:

First, although in the case of the former crisis corporate profits were greatly squeezed by the decline in real income as a result of the worsened terms of trade, they did not suffer such an extreme effect from it this time. Corporate profits, which were not so much decreased, on the other hand, actually served as one of the factors that bolstered the firm conditions in investment in plant and equipment at this time (See Chapter 1.3).

Secondly, in the case of the first crisis, the domestic business conditions a little before the "oil shock" were overheated due to the excessive slackening of the monetary measures adopted during the period from 1971 to 1973. Subsequently, a tight money policy was enforced to cool off



Notes: 1. Sources: The Economic Planning Agency's "Calculation of the National Economy (1978 base)", and Prime Minister's Office's "Labor Survey"

2. Productivity = real GNP/number of employed.

3. The effects of fluctuations in real income due to changes in terms of trade are calculated by the following formula.

$$\frac{(PX_1/PD_1X - (PM/PD - PM_{-1}/PD_{-1})M1/GNP)}{P_1/PD_1}$$

PX: export deflator, PM: import deflator, PD: domestic demand deflator, X: real exports, M: real imports, GNP: real GNP, P: GNP deflator

4. Real wages = (nominal income of employees/total number of employees)/domestic demand deflator

5. Rise in the rate of estimated real wages on the assumption that labor's relative share was not changed = (increase in the rate of productivity) + (effects of fluctuations of real income due to changes in the terms of trade)

Fig. 1. The Relationship of Changes in Terms of Trade with Real Wages and Productivity (Increase or decrease compared with previous year)

over-heated business, and therefore business was already beginning to cool off when the oil shock occurred, and a further retrenchment policy was enforced. Therefore, the significant fall in business activity in the case of the first crisis was brought about not only by the effect of the oil crisis itself but also by the monetary reinforcement measures taken at the time. Looking back on the economic situation of the second oil crisis, on the other hand, business conditions immediately before the crisis were not over-heated and monetary policy remained "neutral". In addition, the rate of money supply increase immediately after the advent of the oil crisis did not result in such a sharp fall-off as in the case of the previous crisis (See Chapter 3.2).

Thirdly, in the case of the first crisis, the estimated rate of growth of enterprises showed a decline, causing a significant slump in plant and equipment investment. This time, however, there was no such factor involved; instead an increase in plant and equipment investment occurred in a more self-sustaining way.

At the moment, the "symptoms of economic recession" are being eliminated and economic conditions in general are gradually improving. This is because of the following two factors. 1) the rate of increase in real income has been recovering due to domestic prices having been stabilized and 2) the rate of decrease inventory investment has been shrinking as inventory adjustment has entered its final phase.

Section 3. Income Distribution and Its Effects

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Reflecting the real income decreases stemming from the deterioration of trade terms, the rate of real wage increases that did not change labor's relative share dropped, i.e. an increase of 2.4% in 1979 and 0.2% in 1980. There was not, however, seen such a large real wage gap this time as in the case of the previous oil crisis because the actual rate of real wage increases also dropped, resulting in an increase of 2.1% in 1979 and minus 0.6% in 1980 (See Fig.1). Consequently, labor's relative share (employee's income/nominal GNP), which moved up only 0.8% from 53.7% in 1978 to 54.5% in 1980, showed a stable trend. And this contrasts strongly with the situation of the previous oil crisis when the same share showed an increase of 5.8% from 48.1% in 1973 to 53.9% in 1975. In the case of the previous crisis, corporate profits had to bear the strain derived from the decline in real income, but this time the burden of the decline in real income was uniformly divided between the income of workers and corporate profits.

The income distribution which showed a difference between the two cases of oil crisis came about because of the following two reasons:

1) Since the decline in production was small this time, labor's relative share did not increase because employment adjustment was so small that there was little delayed adjustment of employment, so it did not pull up labor's relative share.

2) The rate of wage increases remained moderate reflecting the fact that labor supply and demand conditions were not tight, and the rate of prospective inflation (expected inflation rate) was not large. It also reflected the effect learned from the severe experiences of the first oil crisis.

The stable movement in labor's relative share, which was lead by such a stabilized wage condition, brought about the following three good effects. First, the decline in real wages which came from the deterioration of trade terms was easily absorbed by reducing the rate of nominal income increases, and the acceleration of inflation could also be averted.

Secondly, the fact that a sharp rise in labor's relative share was averted and that the rate of increase in wages was not rigid downward, greatly contributed to the stabilization of employment. Thirdly, the stability in labor's relative share prevented corporate profits from decreasing sharply, thus serving as a major factor to maintain a firm basis for plant and equipment investment.

Section 4. Prices Stabilized from Sharp Hike Phase

The domestic price structure which had shown a powerful tendency to rise since 1979 due to the sharp increase in the prices of imported products centered on crude oil, began to moderate its growth during and after the latter half of 1980. Then, subsequent to the first half of 1981, it went on to gradually stabilize.

There are three factors that are considered to have contributed to this stabilization of prices. The first factor was that the previous tendency of imported product prices to increase began to level off in and after the Spring of 1980, and that the spread of the domino effect of the price hikes caused by imported products terminated its first cycle.

Secondly, the nominal growth in demand dropped due to the decline in the growth rate of money supply.

The third factor which helped to stabilize prices was the steady wage growth, helping to avert the vicious circle of wage/price inflation. As stated in Section 3 in this Chapter, the reason why wage growth was stable was because labor supply/demand conditions were not tight and also because the acceleration of the prospective inflation rate that occurred during the previous oil crisis was averted.

Section 5. Balance of International Payments Recovering from Huge Deficit

The crude oil price (customs cleared) soared from $U.S.13.8 per barrel in 1978 to $U.S.33 in 1980. Consequently, the payment for imported crude oil in 1980 increased by approx. $29,000 million (approx. 2.9% of GNP) compared with the level of 1978.

Reflecting this sharp increase in the cost of crude oil and the trend of the declining yen value until the end of 1978, the balance of payments current account deteriorated acutely, registering a deficit of $U.S.13,900 million in FY1979 and $U.S.7,000 million in FY1980. Since the turn of FY1981, however, it has been gradually improving.

A major factor that accounts for this trend is a significant improvement in the balance of trade whereby exports have continued to rise steadily while the upward trend of imports has slowed down.

The long-term capital balance, which showed deficits of $U.S.16,300 million and $U.S.8,400 million in FY1978 and 1979 respectively, went into the black in FY1980, registering a surplus of approx. $U.S.4,400 million. This was due chiefly to the sharp increase in surplus of Japanese securities investment by non-Japanese investors.

The yen value showed the largest fluctuation among all of the major currencies during the period from 1978 to 1981. It reached its peak in October, 1978 at ¥185 against the dollar. However, it then gradually sagged, falling to the ¥252 level in April, 1980. The devaluation in this period was a phenomenon seen only with the yen, and other currencies remained nearly unchanged in their relative values. Furthermore, from April, 1980 the yen value began to rise, reaching a high at ¥202 against the dollar in January, 1981. This time, the movement in the rate of the yen was not parallel but contrary to that of European currencies.

Chapter 2. Recession "Shadow" and Its Causes

In FY1980, business began to decline. Mining and manufacturing production stagnated in the summer and made only a very slow growth thereafter. This time, however, business did not decline so badly as to be called a recession but only to an extent that can be expressed as a recession "shadow" This is basically because the total demand did not show as big a drop as occurred after the first oil crisis, and also may be because of the contribution of experience gained in enterprises or industry sectors after the first oil crisis. From the point of view of the final phase of demand, however, trends this time are considerably different from those previously. In other words, after the first oil crisis, other final demands generally showed a slower growth, though exports showed a considerable growth. After the second oil crisis, in contrast, exports grew and equipment investment remained steady. In other words, a sort of imbalance was observed in final demand in the form of a slower growth of personal consumption and housing investment, in contrast to steady exports and equipment investment. This imbalance in the final phase of demand has had a subtle effect on certain sectors of the economy including industrial production and shipping trends.

Section 1. Inventory Adjustment Found Slightly Unbalanced

Features of Current Inventory Adjustment

Since inventories increase to an unexpected and unwanted extent when total demand scarcely grows or stagnates, companies start inventory adjustment by reducing production or

promoting sales. This time, inventories started a slow growth in the latter half of 1978 and continued it until they reached an adjustment phase in the period between January and March of 1980.

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Evaluation and Progress of Inventory Adjustment

How, then, should the current inventory adjustment be evaluated? In a few words, it may be said that on the whole it was slight, but it was fairly prolonged, espeically in the material type industries.

On the whole, it was slight because (1) the inventory level and inventory-sales ratio at the start of the inventory adjustment were lower than before and (2) the problems of inventory adjustment were confronted primarily by material type industries but hardly at all by processing type industries.

On the other hand, it was fairly prolonged because material type industries as the authors of inventory adjustment had as strong a burden of excess inventory as before and could scarcely get rid of it.

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Section 2. Personal Consumption Recovering from Decelerated Growth

Real private consumption expenditure (on a GNP base) for FY1980 showed a 0.8% growth over the previous year, a much lower figure as compared with the 5.0% growth for the previous fiscal year, and the lowest since 1975. This is because the deflation after the second oil crisis had a relatively stronger effect on the household sector than after the first oil crisis.

From the point of view of classified households, real consumption for workers' households compared with the previous year gradually reduced its negative value in the latter half, after a drop in the first half of the year, while that for general households gradually increased its rate of fall and farmers' households also showed actual negative growth over the previous fiscal year.

Section 3. Housing Investment in a Continuous Slump

Private housing investment (on a real GNP basis) continued scant growth following an almost constant level from FY1978,

and showed in FY1980 a 9.5% decrease, the largest drop since FY1974, resulting in a contribution to the recession "shadow".

The number of housing starts, indicating the trend of housing investment, dropped to 1,210,000 in FY1980 showing an 18.3% decrease from the previous year, after the period between FY1976 and 1979 when the number generally remained at a level around 1,500,000.

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The above factors caused house-building to decline in FY1980. How will it be in the future? From the point of view of the medium-term factors described above, there is no hope of any large increase in demand for the reconstruction of owned houses. However, since the floor space of houses in stock is smaller than that of houses which have started to be built, there seems to be a potentially strong demand for new houses. Under these circumstances, there are signs of a slow improvement in house-building, (though there are still restrictive factors such as the bottleneck in supply of housing sites) in because conditions for house building such as real income, building costs, and requirements for loans are gradually improving.

Section 4. Equipment Investment Supporting Business

Private equipment investment started in the latter half of 1978 to take a recovery course and thereafter played an important role in supporting business in the period of recession "shadow". However, in FY1980, differences in growth were appearing between industries and sizes of business.

Yearly Changes in Equipment Investment and Their Characteristics

Private equipment investment (on a real GNP basis) generally showed a steady growth, though it decelerated to 5.8% in FY1980 after a 10.1% growth in 1979. Above all, manufacturing industries showed a satisfactory growth level. This may be because (1) enterprises recovered their confidence and expected growth rates stabilized, (2) wage costs remained stable because the elastic determination of wages and profit rates of enterprises remained at a high level, and (3) the supply-demand gap for manufacturing industries showed a rapid decrease towards the January–March period of 1980.

Because of the above factors, equipment investment in manufacturing industries as a whole showed growth, and above all, the growth in processing type manufacturing industries manufacturing was particularly prominent. This latter growth showed an upturn in 1976 and thereafter continued steady growth with a significantly high rate after 1980. This was in sharp contrast to material type industries which

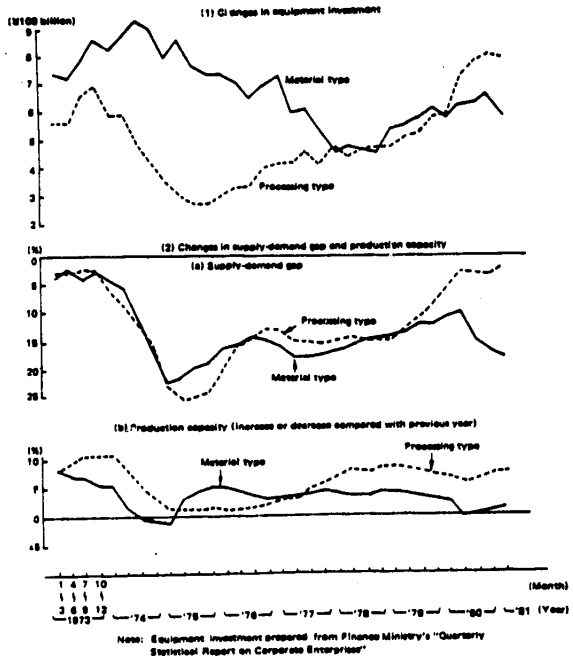

Fig. 4. Yearly Changes in Equipment Investment and Supply–Demand Gap in Manufacturing Industry, by Type

continued stock adjustment till the middle of 1978 and showed an increase only in 1979 (See Fig.4).

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In contrast to these steady trends of major companies, the growth of equipment investment by smaller companies in manufacturing industries decelerated in the latter half of FY1980.

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However, it was gradually improving in 1981 and there is increasing need for investment for technological innovation. Thus, stagnant equipment investment by smaller companies seems to have been very temporary.

Under these circumstances, equipment investment of late can be characterized by, first, the increasing emphasis on investment in energy-saving and research and development; secondly, steady continuous investment in rationalization and labor saving; and thirdly, a gradual increase in investment for expansion of productive capacity.

Since these investment inducements remain steady and the investment environments are improving, private equipment investment is expected to grow steadily.

Section 5. Exports Remain Steady

Exports (real GNP basis) for FY1980 showed a considerable growth continuously from FY1979, playing a role, along with steady private equipment investment, in supporting business.

Exports, in terms of quantity, showed an upturn in the July–September period of 1979 and then gradually accelerated their growth till the April–June period of 1980. Thereafter, though the growth somewhat decelerated, they continued to remain at a high level, showing in the January–March period of 1981 a 12.8% increase over the same period of the previous year. These increases can be ascribed to the following: 1) price factors contributed to increasing exports primarily because of the devaluation of the yen, and 2) demand factors helped to promote exports with the aid of growing world trade in FY1979, but contributed to restructing them in FY1980.

Under the above circumstances, exports remained at a high level for the following reasons:

First, the exports primarily of machinery by processing type industries continued to show high growth. One of the reasons for this is the growth of the non-price competitiveness of goods due to an increase in investment in equipment embodying technological innovation.

Secondly, in processing type industries the degree of machining of goods is very high. This implies that even while the prices of primary foreign products, particularly crude oil, are rising, the increased costs of raw materials will have relatively little effect on goods, and price competitiveness will hardly decrease unless other factors which increase costs arise domestically.

For the trends of exports to different areas, on the other hand, the overall growth of exports from Japan to various areas almost exceeded that from the OECD (except Japan) to the same areas. Above all, the growth of exports to Oceania and Africa was promient.

With generally steady trends in exports, however, products exported from smaller companies were exceeded by those from larger companies after the April-June period of 1980.

Section 6. Recession "Shadow" and Corporate Profits

With business on the upward trend after 1978, corporate profits continued to grow steadily but imbalance was found between sizes. For example, the profits of smaller manufacturing companies turned upwards in the first half of FY1977, subsequently continuing at a high level till the first half of 1979 but turned downwards, ahead of larger companies, in the latter half of 1979. In contrast, larger companies still maintained increased profits in the first half of FY1980, only registering a decline in the latter half of that year.

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Thus, smaller companies were less active than larger companies. This was because the imbalance of final demand and the tight monetary policies had a greater effect on smaller companies. Under these circumstances, bankruptcies increased.

Section 7. Employment at a Standstill in Business Recovery

Employment, on the way to improvement after 1978, was levelling off when the recession "shadow" gradually appeared. The ratio of effective labor demand to effective supply was on the downward trend in the April–June period of FY1980, with the complete unemployment rate rising to 2.15% in the January–March period of FY1981. Meanwhile, however, non-agricultural and forestal labor continued around at an annual 2% growth rate, while housewife labor also continued to increase.

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Although this is partly due to stagnancy of production and marketing activities, the recent relaxation of supply and demand in the labor market is not likely to become very serious. This is because companies made considerable employment adjustment in the period after the first oil crisis and thus there is no significant excess employment pressure within companies.

Under these circumstances, the number of employed people (non-agricultural and forestal) still continued steady growth even at the beginning of FY1981, while business was slowly improving. Since employment trends generally tend to lag behind business trends, these facts are expected to have a favorable effect on the reduction of unemployment, and the labor supply-demand situation is expected to return to an improving trend.

Chapter 3. Unfolding of Fiscal and Monetary Policy and the Problems Awaiting Solution

The effective and timely operation of fiscal and monetary policy may be picked out as one of the background factors allowing the Japanese economy to maintain a good performance despite the effects of the second oil crisis.

Section 1. Effective and Timely Operation of Monetary Policy and the Financial Markets

1. Monetary Conditions Relaxed

Strict monetary restraints have been carried out to cope with the difficulties caused by the second oil crisis. These

obtained good results in preventing home-made inflation. However, with explicit signs of the deflationary effects of the raising of the oil price, the tight money policy turned to relaxation. Reflecting the last tight money policy, the following three features were observed.

1) Interest rates rose at a fairly high tempo in the period of tight money policy. This stabilized prices to create room to turn quickly toward a relaxation of this policy. As a result, Japanese interests rates have become the lowest among the major countries.

2) In corporate finance, there was seen a situation whereby the private sector evaluated the process of monetary policy as having changed from "a tight money policy without a feeling of tightness" to "a policy of relaxation without a feeling of relaxation" (See Fig.5). This does not mean that the effects of the monetary policy at that time decreased, although it is true that the effects of monetary policy on corporate finance through the channel of financial institutions became small, as enterprises had multiplied their financing channels. But liberalization of interests rates, which was another aspect of the multiplication of financing channels, brought about high interest rates in these channels to influence the corporate demand for funds itself. This expansion of channels through which the effects of monetary policy works brought about the above-mentioned phenomenon.

3) The stance of financial institutions on lending money changed compared with the period after the first oil crisis. Even in the period after monetary policy turned to relaxation, the increase rate in bank leading was slow compared with that in the relaxation period after the first oil crisis. In particular, lending for small and medium-sized enterprises by financial institutions, such as mutual loan and savings banks and credit associations was sluggish. This was a feature of the time and suggests that the management environment was worsening for all financial institutions so that they had to change their lending stance to expand loans quantitatively, which had been the prevailing situation before the last tight money policy.

On the other hand, it seems a noteworthy phenomenon, which indicates changes in the financial market structure, that the financing channels of city banks had diversified along with the liberalization of interest rates and their position was improved.

2. Stabilization in Money Supply and the Fall in Interest Rates

After the slackening of the tight money policy in April 1979, the increase in the money supply continued to follow a gradually decelerating trend up to the beginning of 1981, though the trend was moderate. Under these circumstances, market interest rates registered a significant increase at the beginning, but after the middle of 1980 they showed a favorable decline.

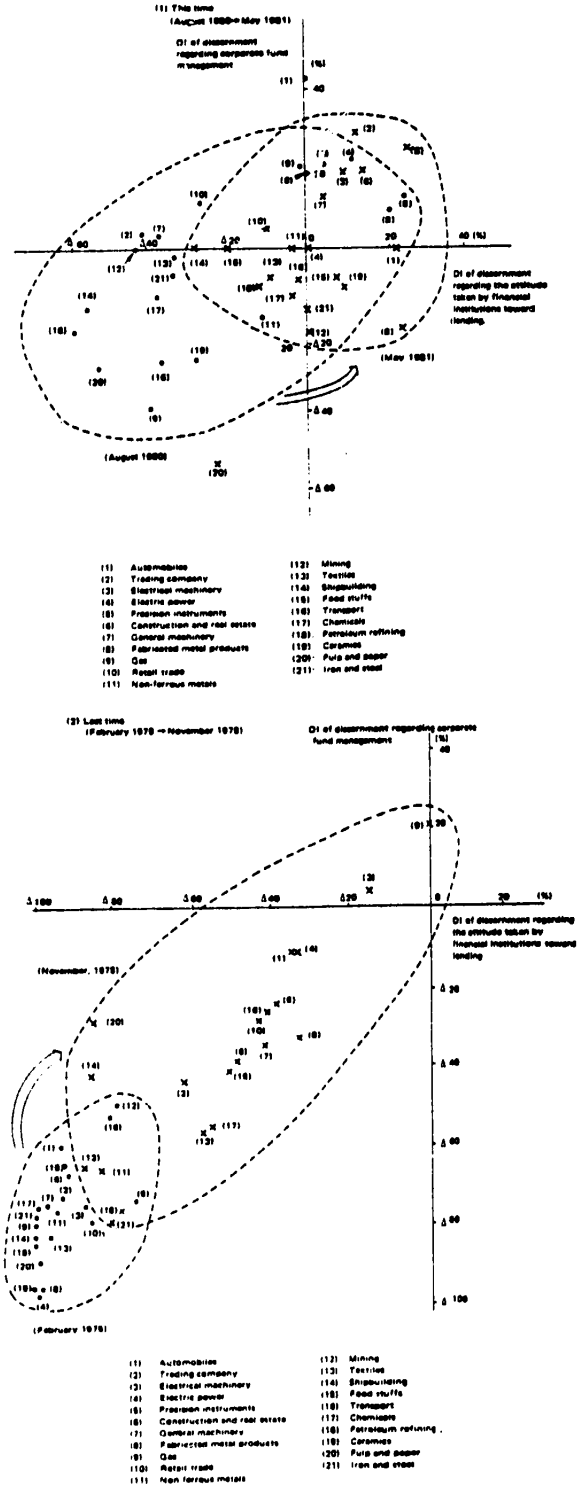

Fig. 5. Change in Discernment of Corporate Finance in the Period of Monetary Relaxation

When growth in the money supply is suppressed, interest rates go up to start with because the supply of currency is decreased. This is followed by a decrease in nominal incomes and thus is followed by a decrease in the demand for currency. This then functions as a factor to lower interest rates. Further, if suppression of the money supply makes the growth rate of prices slow down, the expectation of inflation becomes calmer, and as a result, nominal interest rates decrease still more. As seen above, the appropriate control of the money supply results in lower interest rates in the long-term, and we can say that the Japanese experience after the second oil crisis demonstrated this hypothesis.

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3. Liberalization of Interest Rates and the Movement of Long- and Short-term Interest Rates

The evolution of the liberalization and the flexible operation of interest rates in recent years has been highly significant as a background to the effective and timely operation of monetary

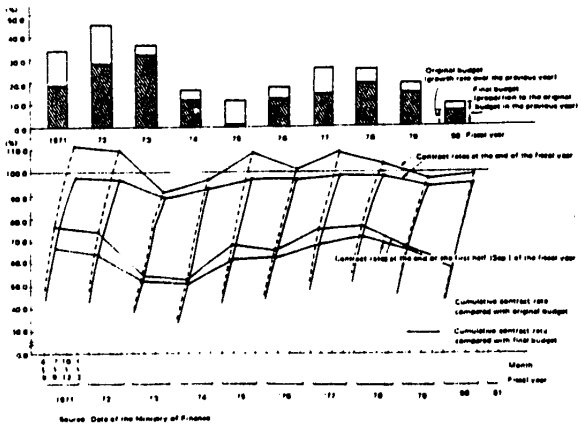

Fig. 6. Yearly Change of Public Works Expenditure Budget and Contract Rates

policy and its effects since the second oil crisis.

In particular, the following fact is notable. As the call market and the discount market, where monetary policy has a direct effect, had been fully liberalized, arbitrage transactions increased between these markets and the open market, including the Gensaki-market (a market for bond trading with a short-term repurchase agreement), and the C.D. market, resulting in stronger interconnectedness between the short-term money markets. In the process of liberalization of interest rates, it has been clarified that a normal market mechanism is basically operating in the Japanese monetary sector, which had conventionally been apt to be regarded as a special Japanese-type of monetary market.

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Section 2. Fiscal Operation Under Tight Condtions

1. Budget Compilation Aiming at Financial Reconstruction

Large-scale finance up to FY1978 played a large part in returning the Japanese economy to a stable economic growth course. In this process, the financial deficit was expanded, and thus, financial reconstruction has become an urgent problem. For this purpose, growth rates in the general account of annual expenditure from 1979 to 1981 have been maintained at a very low level. On the annual revenue side, income tax revenue has begun to recover favorably since FY1978 when business showed a recovery, and in the fiscal 1981 budget, measures for a tax increase were taken. As a result, the rate of reliance on public bond issues, which had continued to increase after FY1975, began to decrease from 1979.

2. Fiscal Operation Changing from the Suppression Type

Even under tight constraints, such as the financial reconstruction, fiscal policy after the second oil crisis has been operated both effectively and opportunely (See Fig. 6).

Looking at the execution of the public works budget, the 1979 budget was primarily compiled to promote business recovery. However, it was executed as a neutral type budget from the beginning, reflecting the full-scale business recovery and the worsening of the price performance. Furthermore, in the latter half of the fiscal year, a 5% cutback in public works was enforced as a part of the measures against price rises. Thus, the ratio of public works contracts (contracted amount/budget) at the end of the fiscal year remained at a low level of 93.6%, which was the lowest since 1974. The public works budget for FY1980, which was formulated for a very small growth over the previous year, was executed as a restraining type budget placing primary importance on price stability.

Such restraining type operation of fiscal policy greatly contributed to preventing home-made inflation. But from mid-1980, the restraining measures were cancelled to cope with signs of a recession. And, in the latter half of FY1980, positive measures were taken to sustain the level of business activity. As for the 1981 budget, the Government decided on about a 70.5% ratio of public works contracts in the first half of the fiscal year.

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Section 3. Facilitating Measures Against Price Rises, and Economic Measures

Analysing the progress of economic measures, which were taken to cope with the second oil crisis, it is noteworthy that

measures against price rises were taken in good time, and that importance was placed on stabilization of prices.

Reflecting the steady trend of prices and the growing signs of a recession after the middle of 1980, economic measures were decided upon both in September 1980 and March 1981. The features of these measures were as follows:

1) The economic measures which were implemented were macroscopic ones composed of two axes, namely the fiscal and monetary aspects mentioned above.

2) The macroscopic measures were made up of fine-grained microscopic ones. For instance, measures for small and medium enterprises, and the promotion measures for house building were adopted jointly in the two economic measures mentioned above. In particular, in the economic measures of March 1981, concrete actions for both smaller businesses and house building were decided. This was because these sectors were suffering most under the influence of the recession "shadow", which progressed at an unbalanced pace among the sectors.

3) Even during the recession "shadow", actions against price rises had remained as one of the major supports for the economic measures. This was because the Government stabilization of prices was the most important requirement for achieving sustained economic growth.

Section 4. Oil Crisis and Economic Performance

The Japanese economy, which experienced severe stagflation after the first oil crisis, has shown the most stable performance among major advanced countries since the second oil crisis period. Comparing the two crises there is little difference between them in regard to the deterioration in the terms of trade. Nevertheless, why did such a difference in the economic performance of Japan occur? As reasons for this, there were favorable factors such as stability in the rate of wage increases, and rational countermeasures of households and enterprises. Apart from this, the economic conditions just before the two oil crisis (incipient conditions) were substantially different, which, it seems, influenced Japan's economic performance fairly greatly. Such differences in incipient conditions include, and are related to, various factors including the difference in phases of business activities. On the other hand, differences in money supply and fiscal expenditure, which were due to the differences in the phases of business activities as well as the differences in economic measures (that formed the background to the phases of business activities), may have had a varying influence on economic conditions just before each oil crisis respectively.

Before the first oil crisis, both money supply and fiscal disbursements fluctuated widely, influenced by the Nixon Shock and the adoption of business stimulation measures to cope with the undesirable effects of the Shock. Against this, fiscal expenditure before the second oil crisis recorded a large increase rate similar to that before the first crisis. In this situation, the growth rate of the money supply increased but

its movement was much calmer compared with the first oil crisis. From this we may conclude that the difference between the change in money supply before and after the first oil crisis was very large, while that before and after the second crisis was small, and that this caused the significant difference between the two performances of the Japanese economy at those times. The movements of the money supply during the first and second oil crisis were reversed and simulated simple econometric time series models. As a result, it was found that the movements of prices and the real GNP had changed considerably.

Conclusion of Part 1. The Present Phase of Prices and Business

The adjustment process of the Japanese economy in response to the second oil crisis is now ending. The prices of imported goods have come to be stabilized in the event that the rate of increase of oil prices has levelled off. Thus, the terms of trade have continued to be unchanged since the second quarter of 1980, and the various effects caused by their deterioration have been gradually eliminated. In respect to prices and the international balance of payments, the Japanese performance has greatly improved in FY1980 as seen earlier. Also the recession "shadow" which appeared in FY1980 is coming to an end and, moreover, inventory adjustment in the material type industries has on the whole nearly finished to level off or to continue decreasing, both in actual amount and in the inventory–sales ratio. Personal consumption has turned to increase in real terms supported by the stabilization of consumer prices. There are also signs of recovery in housing construction, and promotion measures have been taken for the execution of public works. Equipment investment and exports are tending upwards, though the growth rate is not as large as previously.

In this environment, business activities generally are showing an upward tendency and the adjustment process is coming to an end. Thus, with regard to trends of business activity in future, it is necessary to pay attention to the following five points:

1) The influence of the recession "shadow" is now appearing in employment with a time lag, and there is an easing in the labor supply-demand situation.
2) There is a possibility that the recession "shadow" will partially continue, as shown in the phenomenon that among structural-recession industries production cutbacks still continue.
3) It is necessary to monitor continuously the movement of prices, while stably controlling the money supply.
4) The influence of the European and American economies, which are still in an unstable phase, is reaching to the Japanese economy in some areas.
5) Uncertainty is increasing throughout the world political and economic scene.

Part 2. Vitality of the Japanese Economy, Its Features and Problems

Introduction. Vitality of the Japanese Economy and Problems

For some 100 years since the Meiji Restoration, Japan has learned from Europe and America and, in doing so, it has set an objective of "catching up" with them. Now, after recovering from the devastation of World War II, Japan has reached the level of the advanced countries in many fields, such as the size of the economy and technology.

However, the Japanese economy is confronted with new problems. First, how will the private sector economy, which is the motive power of economic development, be maintained and improved?

Second, how will the government perform, efficiently and impartially, its role in the public sector, which cannot be borne by the private sector economy?

Third, how will the vitality, as seen in the Japanese economy, be employed efficiently by the world economy and how will it be accepted?

Fourth, how will the quality of housing, which is indispensable to the stabilization and promotion of national life, be improved, and how will leisure, which likewise is indispensable, be employed wisely?

In order to solve these problems, not only the "vitality to adapt to the environment" but also the "vitality to improve the environment" are necessary. The "vitality to improve the environment" indicates the high degree of Japan's creativity in that success has been made possible by imitation. What Japan, as a nation, should do today is to make the most of this creativity and, if possible, to further enhance it, and to manifest the vitality to improve the environment both at home and abroad.

Therefore, even if the core of the problem in this chapter may appear as though the vitality of the economy is, at a glance, a special feature of Japan, it will be clarified that the problems are based on universal and rational factors. Thus, while considering "cultural differences", an analysis will be made which will make possible "common understanding" between various countries of the world.

Chapter 1. Vitality of the Private Sector and Its Problems

Although Japan's economy was greatly affected by the second oil crisis, it has developed satisfactorily and is in a better condition than the other leading industrialized countries. This is attributed to the rational actions taken by enterprises and households in response to the economic situation. We would like to call it the vitality of the private sector.

Table 7. Comparison of Objectives and Organizations of Enterprises between Japan and U.S.

(a) Comparison of business objectives

Objective	U.S.	Japan
Earning rate of investment	2.43	1.24
Rise in stock prices	1.14	0.02
Market share	0.73	1.43
Improvement of product portfolios	0.60	0.68
Rationalization of production and goods distribution system	0.48	0.71
Owned capitalization ratio	0.38	0.59
Ratio of new products	0.21	1.06
Enhancement of company's social image	0.06	0.20
Improvement of working conditions	0.04	0.09

(b) Comparison of voices in enterprises

Section	U.S.	Japan
Sales marketing	3.78	4.08
Research and development	2.71	3.29
Manufacturing	3.20	3.66
Financial accounting	3.61	3.27
Personnel affairs, labor	2.34	2.72
President's office, planning	2.76	3.34
Materials, purchase	1.93	2.73

Notes: 1. Source: "Strategies and Organization of Japanese and U.S. Enterprises," written by Tadao Kagono, assistant professor at Kobe University, Ikujiro Nonaka, Professor at Defense College, Kiyonori Sakakibara, full-time lecturer at Hitotsubashi University, and Akihiro Okumura, assistant professor at Keio University

2. Time of research: April–August, 1980
Objects of research: Japan – 1,031 manufacturing companies whose stocks are listed on the 1st and 2nd sections of the Tokyo Stock Exchange
(Of these companies, 281 replied to questionnaire.)
U.S. – 1,000 companies in the mining and manufacturing industries which were top-ranked by Fortune Magazine in 1979
(Of these companies, 227 replied to questionnaire.)

3. Each enterprise was given 3 points for the item it placed first, 2 points for second place, 1 point for 3rd place, and 0 point for others. The figures in (a) and (b) tables are the average values calculated for each of them.

Section 1. High Labor Productivity and Its Background

Labor productivity of the Japanese economy (on a GNP basis) showed a high average annual growth rate of about 8.5% during the period from 1960 to 1973. After the first oil crisis, however, the rate dropped to 4–5%, but was still the highest among the major advanced countries.

As a background to this, first, capital equipment registered a high growth rate due to active capital investment. Second, technological innovations were unfolded in parallel with equipment investment. For example, the production of manufacturing industry rose by 12.4 times during the period from 1965 to 1980. Of this, it is estimated that about 30% was due to technical innovations. In fact, the period up to around 1965 was one of technological innovations based on the introduction of technology from foreign countries. The subsequent period up to the oil crisis was a period of large-scale technology in pursuit of economies of scale. It was also a period for coordinating and diffusing technology. After the oil crisis, efficiency-type technological innovations and mecatronics-type innovations in manufacturing industry made headway for the purpose of energy and oil conservation. A representative example of the latter is industrial robots which have rapidly come into use recently.

Third, in the process of high economic growth, the significance of the low productivity sector in the industrial sector

decreased. That is, the significance of primary industries decreased while that of the manufacturing industry increased.

Fourth, the way in which enterprises and laborers acted spurred technology innovations which were accepted. In viewing the modes of behaviour of Japanese and American enterprises on this point, Japanese enterprises apparently make investments with long-term objectives in mind. On the other hand, American enterprises are sensitive to making profits within a short period, and even if investment is deemed indispensable to their growth, they tend to avoid making investments which do not pay off in the short run (See Table 7).

As Japanese enterprises grew and employment opportunities increased, labor tended to take a flexible attitude in accepting technological innovations. This is ascribed to factors such as (1) active on-the-job training within enterprises under the life employment system, (2) labor unions by industry are aware that the prosperity or decline of enterprises is closely connected with the interests of workers, and (3) under the wage system for long service, changing from one job to another in the same workshop will not affect wages. Moreover, positive proposals for raising the efficiency of production processes and for quality control have been made from the labor side.

Section 2. Labor Market Absorbs Oil Shock

After the first oil crisis, the rate of wage increases in Japan was the highest among the advanced countries. Furthermore, production dropped appreciably. On the other hand, the adjustment of the number of workers employed was delayed so that unit labor costs of enterprises rose. However, since 1976 unit labor costs, unlike in Europe and America, have tended to stabilize. One of the reasons for this is that the pace of inflation slowed down due to the effects of financial measures taken by the government in the midst of the prolonged decline in employment after the first oil crisis because of the delay in adjusting employment.

In cases where the earnings of enterprises are expected to to drop, there is a strong possibility that the labor unions by industry, in the course of wage negotiations, will opt for a low wage increase by placing more importance on securing employment. Moreover, it cannot be denied that fluctuations in wages have been made flexible by the bonus system.

Section 3. Progress of Energy Conservation

Japan is greatly dependent on oil as a source of energy, and lacking domestic supply, has no other option but to rely on imports of this vital commodity from abroad, mainly the OPEC countries. Consequently, among the advanced countries, Japan particularly has been hit hard by increases in the price of oil.

The oil price increases have brought about three effects (the Japanese use the word "trilemma" – short for three

dilemmas – for the three defects), namely, the oil deficit (unfavorable balance of international payments due to the increase in payments for oil), oil inflation (imported inflation due to the increase in the cost of oil), and oil deflation (outflow of revenue to foreign countries due to the increase in oil charges).

At any rate, the effects of the second oil crisis have been twice as great as those of the first oil crisis. As the oil price increases have not only produced the "trilemma" but will also raise their ratio to the size of the nominal amount of oil imports, the effect of oil price increases will be heightened every time the price of oil is raised. In order ultimately to escape from this vicious circle, therefore, the only way is to switch over to alternative energy sources. On the other hand, efforts should also be made to promote the efficient use of oil and to raise oil productivity (real GNP/oil consumption).

Throughout the first and second oil crisis, Japan's oil productivity increased sharply. As the home-made inflation was averted particularly after the second oil crisis, the rise in the price of oil was higher compared with other commodities, so that economizing on oil was pushed forward (See Fig.8). Material-type industries, such as chemicals and iron and steel, have reduced their basic unit of energy, which has produced a marked effect on the economy drive. A switchover of the iron and steel, ceramic and clay industries from oil to an alternative energy source has also contributed to the drive.

Enterprises and households are still proceeding with conserving energy and oil and investments for this purpose are notable in enterprises which consume large quantities of energy. The purposes for which investments are made have changed from readjusting methods of operation and improvement of operational control to installing new equipment and also large-sized equipment to keep up with the newly-installed equipment.

In the iron and steel industry, active investment for energy conservation in the continuous casting and rolling sectors is being made, while the use of furnaces which do not use oil is spreading. Industries such as the paper, pulp, chemical, ceramic and clay industries, too, are making active moves to invest for energy conservation.

Households are also economizing on energy to cope with the rise in the price. Moreover, in order to propel this form of energy conservation, efforts are necessary to equip houses with insulation devices and energy-saving electrical appliances.

Section 4. Future Problems of the Private Sector

Confronted by such issues as the increased limitation of energy and the ageing of society, the Japanese economy will be beset with severe problems in the future. In order to secure stable growth of the economy, it is thus necessary to sustain the vitality of the private sector and to make it more creative.

Maintenance of a Competitive Environment

In the Japanese economy there is brisk competition among enterprises. It is because of this that Japan attained high economic growth and energy conservation after the oil crisis. However, with the rate of market growth slacking, enterprises have come to act more in concert with each other, and it is feared that this will cause problems in industrial vitality.

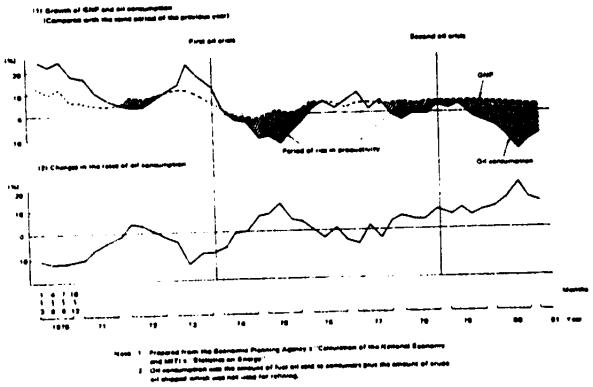

Fig. 8. Yearly Changes in Oil Productivity (real GNP devided by oil consumption)

Depending on changes in the economic environment, it cannot be denied that there is a possibility that government regulation of industry will bring about distortion of the distribution of resources. In order to sustain and increase competition therefore, it is important to review these matters.

Future Technological Development

With the exception of high technology, such as in aircraft, nuclear power equipment and information processing, the level of Japanese technology is comparable with that of countries in Europe and America. In iron, steel and automobile manufacturing, Japanese technology leads the world. Although the process of technological development was based on the introduction, application and systematization of existing technology at home and abroad to meet economic needs, most of the work has been borne by the private sector. As far as innovations centering around mecatronics are concerned, applied technological development is Japan's forte. However, from a long-range viewpoint, technological development in the basic areas and a social assessment of scientific technology are important.

Further Promotion of Energy Conservation and Development of Alternative Energy

Restrictions in oil are of a continuing nature and efforts to conserve energy and oil must be made with increased vigor in the future. But, there are limits to conservation. Accordingly, it is necessary to switch over to other sources of energy, such as coal and LNG, as well as to stimulate the development of an alternative energy to coal, such as atomic energy, so as to lighten restrictions on energy. Ensuring safety is also a major prerequisite particularly with regard to atomic energy. And, in utilizing atomic energy, it is necessary to promote its acceptance both at home and abroad.

Promotion of Efficiency in Agriculture

In order to sustain the vitality of the national economy, it is necessary to raise the productivity of the agricultural sector. Japan's self-sufficiency ratio of farm produce for food dropped to 72% in 1979. Moreover, productivity of labor is low due to the small size of farms and, depending upon the products, there is a wide disparity between their prices and international prices.

Furthermore, the fact that the government's purchase price of rice is maintained at a high level compared with other agricultural products has increased the trend among farmers with small-scale plots to cultivate rice.

As the part-time farmers rely greatly on the income from their side jobs, they do not have a strong will to raise agricultural productivity. Moreover, there are problems with respect to effective utilization of farm-land, machinery and facilities. In particular, there is a high emphasis on rice cultivation amongst part-time farmers whose productivity is relatively low, and this is hampering the advancement of the entire agricultural sector.

Under these circumstances, moves are being made to improve the situation, which, in agriculture, means better land utilization, and expanding the scale of management to raise productivity. However, buying farm-land is difficult because of its high price.

There is however a possibility of expanding the scale of practical management by expanding the management of leased land. Contributing factors are: (1) Against a background where a rise in the actual price of rice cannot be anticipated, the difference in earnings between the various scales of management will be increased. (2) Under the present situation where the dependence of part-time farmers on the income from their side jobs is increasing, it is anticipated that their will to manage their farms under unfavorable conditions will decline. (3) The part-time farmers are ageing.

Thus, in order to expedite the expansion of scale of farm management, an environment wherein a competitive principle can be incorporated should be maintained. Accordingly, it necessary to induce competent men to work in farming as well as to foster men of talent and improve agricultural technology.

Chapter 2. The Role and Review of the Public Sector

The second problem with respect to maintaining and fostering the vitality of the Japanese economy involves the public sector and its review.

Section 1. The Present Condition of Deficit Financing

The Japanese Government's revenue and expenditure have greatly worsened since the first oil crisis. Moreover, the government's dependence on public bonds has pursued an upward trend since FY1974 and reached 39.6% in 1979, which is exceptionally high in time of peace. In the government's budgets for FY1980 and 1981, the reliance on public bonds declined, but it was still at a fairly high level of 26.2% in the FY1981 budget.

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While carrying such a structural deficit, the national economy has recovered to a satisfactory performance in respect of prices of goods as well as business and employment. This is in contrast to countries in Europe and America which are compelled to carry on a painful economic situation in the midst of deficit financing. Japan's condition arose as a result of deficit financing being limited to the area of excess savings of the private sector. Moreover, if the scale of Japan's deficit financing is compared with those of the United States and Britain, the following is observed (See Fig.9):

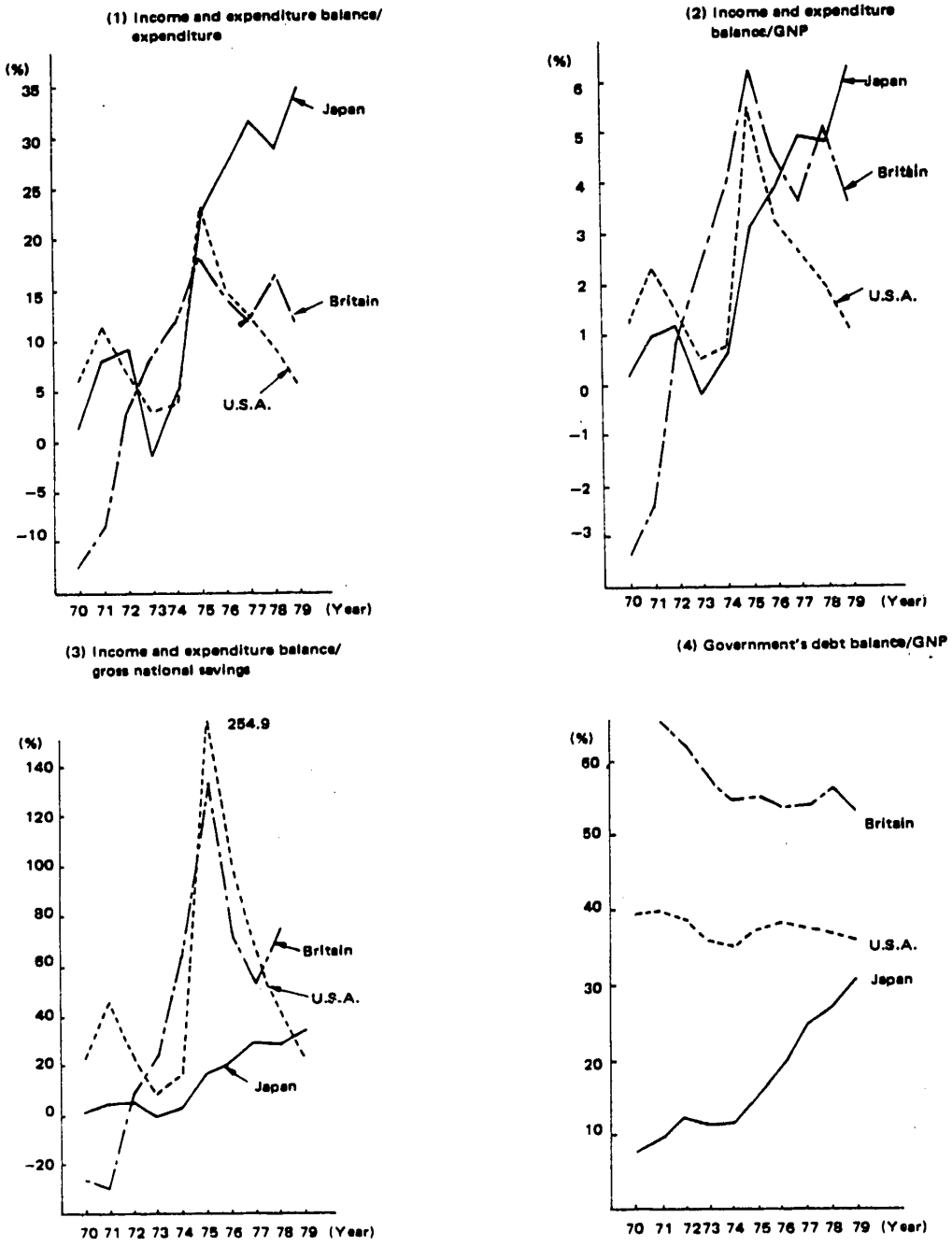
(1) The level of dependence on public bonds (relative to the size of expenditure) is very high.

(2) This level compared with the size of the economy (GNP) is also high but not as high as (1).

(3) The ratio of deficit financing to gross national savings has risen considerably, but it has a special feature, that is, its level is still low. The degree of risk of the so-called "hardening of finance" is high, but the relatively small scale of the expenditure itself has not made conspicuous the ill effects of deficit financing up to now.

However, the balance of savings investment has changed considerably recently. The excess savings of the private sector have shrunk since 1979, and if public bonds continue to be issued in the future, the private sector's demand for funds will be compressed. Thus, it cannot be said there is no fear that conditions in the money market will become difficult.

In fact, it is reported that, in the United States and Britain, the baneful effects of deficit financing have come to the fore. Added to this, it should not be overlooked that the feeling of enduring deficit financing is lighter compared with a tax increase and is apt to be linked to "big government". In this context, it cannot but be said that an improvement of the financial balance is an important problem for the entire Japanese economy.



(Notes)
1. Prepared from Bank of Japan's "International Comparison Statistics", etc.
2. Minus indicates financial surplus.
3. Statistics for Japan and Britain are for fiscal year (April–March).
   U.S.A. is for calendar year.

Fig. 9. International Comparison of Scale of Deficit Financing

Section 2. Review of the Public Sector and Raising Its Efficiency

A review of what the public sector should be has become an urgent problem. The main points are: 1) Avoiding the tendency for deficit financing to continue increasing. (2) Maintaining a proper size of the public sector. (3) Checking whether there is wasteful and inefficient spending in the public sector. (4) Securing a fair share with respect to revenue. (5) Such efforts have already been made in the other advanced countries and there are many points which Japan should learn.

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From the standpoint of international comparison, the public sector in Japan has continued to be limited to relatively small government. However, the public sector raised the significance of the government in the midst of high growth but was still able to increase its vitality smoothly. With the economy continuing to grow, the weight of the public sector is gradually rising. In the 1960's, government expenditure was around 18% of the GNP, while recently the ratio has exceeded 30%.

As a future problem, even if the present expenditure structure is unchanged, the possibility of the significance of the public sector rising further assumes importance. For instance, the population of Japan is expected to age rapidly in the future and, along with this, it is anticipated that the expenditure related to social insurance will inevitably increase. Moreover, the ratio of social insurance in Japan is by no means low if the population composition is taken into account. Due to ageing, it is estimated that social insurance in the year 2000 will rise to the present level of Western countries (See Fig.10).

Also, the probability of the national economy owning big government is not small. On this point, it is believed that the time has come for the Japanese people to learn afresh from the experiences of the advanced welfare countries.

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Section 3. Vitality and Creativity of the Public Sector

What is the real role of the public sector? Generally "efficiency" in the national economy has been brought about solely by free competition in the market. It has often been thought that a "failure of the market" is compensated by securing "fairness" in the public sector. "Small government" regards the public sector as being essentially inefficient. Consequently, people who seek positive significance in the public sector have a strong sense of distrust of the market economy. However, with the switchover to stable growth, efficiency in the public sector has come to be demanded. Even in the public sector, "efficiency as an organization" has become an important matter in order to realize economic and social objectives.

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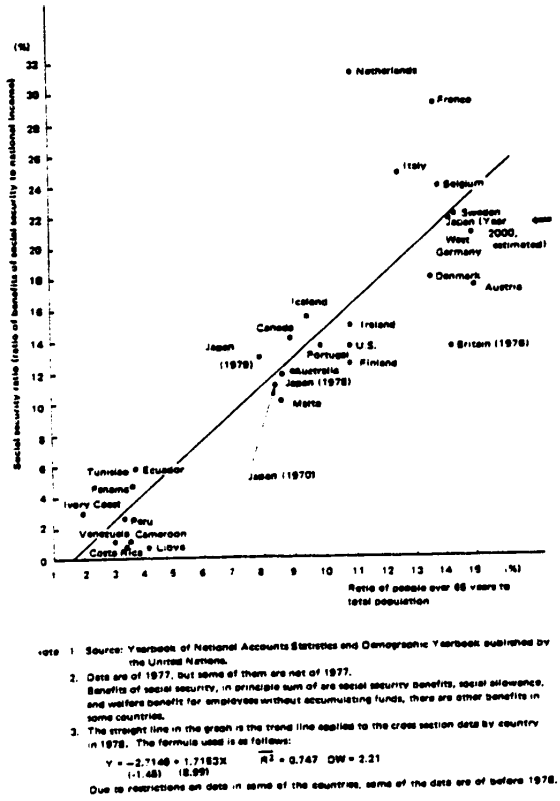

Note 1. Source: Yearbook of National Accounts Statistics and Demographic Yearbook published by the United Nations.

2. Data are of 1977, but some of them are not of 1977. Benefits of social security, in principle sum of are social security benefits, social allowance, and welfare benefit for employees without accumulating funds, there are other benefits in some countries.

3. The straight line in the graph is the trend line applied to the cross section data by country in 1978. The formula used is as follows:

$$Y = -2.7148 + 1.7163X \qquad \overline{R}^2 = 0.747 \quad DW = 2.21$$
$$(-1.48) \quad (8.99)$$

Due to restrictions on data in some of the countries, some of the data are of before 1978.

Fig. 10. Ageing of Population and Social Security Ratio

Section 4. Finance and the Public Sector

Japan's financial structure changed greatly after 1975. The public sector was the one which most lacked funds, and the extent of a shortage of funds in corporate enterprises diminished considerably. As regards the deployment of funds in households, a changeover from liquidity deposits to income earning savings was seen, indicating a move placing more importance on profitability.

On the other hand, the market for public bonds and debentures expanded rapidly, and their sales, which amounted to only 9 trillion yen in 1970, exceeded 200 trillion yen in 1979. Interest rates gradually came to fluctuate freely, and it became clear that a market mechanism was basically at work in the money market. It can be said here that Japan ranks with the United Stages as the most advanced nation in financial markets.

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Chapter 3. Formulation of Japanese Economic Vitality Which Will Be Accepted in the World Economy

Japan's economic position in the world economy has become increasingly important, but it has come to face a serious problem, namely, how the economy can make the best use of its vitality and be accepted and welcomed by the international economic community, which is suffering from uncertainity. There are in fact three issues.

(1) International trade frictions have begun to take place between Japan and the advanced countries. The first problem for Japan is how to cope with these frictions.

(2) Differentials in income per capita between the advanced countries and the non-oil producing developing countries, especially the LLDC, have become wider. The second problem is how and in what form Japan should carry out its economic cooperation with these countries under these circumstances for their economic development.

(3) The third problem is what monetary role Japan should seek in the world economic community.

From the latter half of the 1970's, the Japanese money market has internationalized rapidly but the effect of this development on Japanese monetary policy has not yet revealed itself.

Section 1. Intensification of Trade Frictions

With regard to trade frictions between Japan and the advanced countries, many of them took place in the field of textiles, and iron and steel from the 1960's to the first half of the 1970's. Entering the 1970's, new aspects of friction, such as those concerning color TVs, and shipbuilding industries, etc. became issues. Recently, frictions are focusing on the machinery industry, including automobiles, machine tools, etc.

There are two features from the viewpoint of the period of these frictions: a) they became strong in the second half of the 1970's, and b) they eased for a time after 1978, but after that they appeared to start to strengthen again. We can point out three factors as a background to these trade friction issues:

(1) Price competitiveness of Japanese products centering around machinery has become relatively strong against that of other advanced countries leading to a larger market share for Japanese goods in the American and European markets.

For example, American unit labor costs increased by 6.1% annually on average during 1975–1979, while those of Japan decreased by 0.8%. Such differentials as these have remarkably strengthened the price competitivenss of Japanese goods.

In this context, the reason why the trade friction issue eased for a time after 1978 was because the increase in the yen exchange rate worked as a counterbalance against the increase in price competitiveness of Japanese goods.

It is not correct, however, that increased imports from Japan did large damage to the corresponding industries of the importing countries. As shown in Fig.11, an analysis of fluctuation factors in the 1970's of employment of American manufacturing industry by sector indicates that the effect of imports on employment was small, while a decrease in domestic demand and a movement in productivity had a much larger influence. Therefore, it is largely due to the conditions in the importing countries that the increase in imports has been linked to trade frictions.

(2) The second factor is the domestic conditions in Europe and America as importing countries, such as the inclination to intensify protectionism, and uneasiness over employment. As mentioned, those goods which have experienced trade friction with Japan vis-a-vis the advanced countries are textiles, iron and steel, automobiles, etc., where the advanced countries are gradually losing their comparative advantages in the field of unit labor costs, product cycles, etc., as seen in the U.S.

From the viewpoint of the international division of labor, it is desirable for those countries which are losing their comparative advantage in some specific industry to reduce the size of that industry, thereby turning the market of the industry over to those countries where the corresponding industries have developed comparative advantages, and to assign labor and other resources to those industries or commodities for which they have comparative advantages.

As seen lately in the U.S. and some European countries, the chances for an industry, which is losing its comparative advantages, to succeed in developing new products or shifting its industrial field are becoming less when the potential economic growth rate has become small. With these facts, they are apt to try to stick to the "status quo" as much as they possibly can. For example, in the case of textiles and steel in the U.S., they attempted to protect their vested interests by curtailing imports.

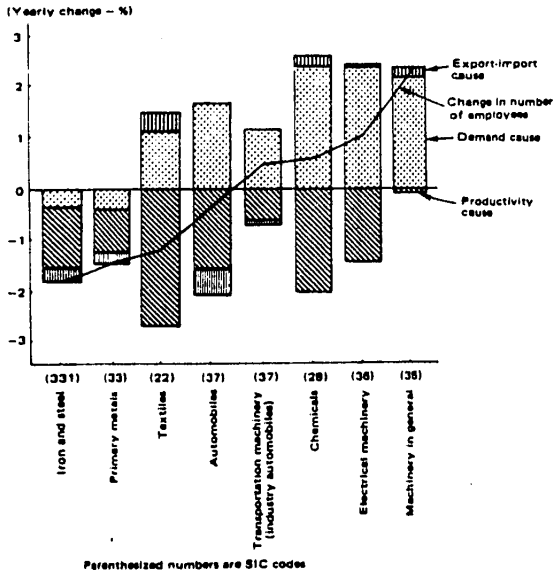
(3) The third factor is lack of mutual understanding between Japan and the U.S., and, Japan and the EC countries. A misunderstanding that one's counterpart is strengthening its competitiveness by unfair measures generates a desire to take countermeasures which often leads to movements for protectionism, e.g. a) Japanese industry is intensifying unfair export attacks with governmental support and based on a special financial system, b) the Japanese domestic market is closed to overseas industries, c) Japan is trying to grow economically overly depending on exports. These are typical examples of such cases.

It is advisable to adopt six major policies for easing international trade frictions:

(1) The first is to rejuvenate the economies of the advanced countries. This is very important, and along with these measures, it is necessary to create a good economic environment to cope with retrogressive activities aimed at protecting vested interests by bringing pressure to bear on their governments.

(2) It is important for Japan to take leadership with West Germany to safeguard the free international trade system, which is unsettled due to the relative weakening of the United States' economic strength.

(3) Japan should import finished products from advanced countries.
(4) Development of industrial cooperation including direct investment will help ease trade frictions.
(5) It is necessary to promote mutual understanding at various levels including governmental, corporate, etc.
(6) It is necessary to pay attention to orderly exports, taking into full account the market trends of importing countries.



Notes: 1. Sources: U.S. Commerce Departments "Survey of Current Business" and Labor Department's "Monthly Labor Review" and "Employment and Earnings".

2. An analysis of the causes of changes in the number of employees was made by the following method.
Regarding Period-t of a certain industry, value of domestic consumption: $Ct=Qt-Xt+Mt$
Labor productivity per person: $At=Qt/Lt$
Domestic production share of domestic consumption $St=Qt/Ct$
(Qt is shipment value, Xt export value, Mt import value. These are 1967 prices. Lt is number of employees.)
Based on the above,
$At \cdot St \cdot Ct = Lt/Qt \cdot Qt/Ct \cdot Ct = Lt$,
Therefore, $Ct=Coe^{\beta t}$, $At=Aoe^{\delta t}$, $St=Soe^{\alpha t}$,
$Lt=Loe^{\gamma t}$ (Co, Ao, So, Lo are values at the first stage.)
Based on the above,
$Lt=Loe^{\gamma t}=At^{-1} \cdot St \cdot Ct$
$=Ao^{-1}e^{-\delta t}Soe^{\alpha t}Coe^{\beta t}$
$=Ao^{-1}So\,Co \cdot e^{(-\delta+\alpha+\beta)t}$
Consequently $\gamma=-\delta+\alpha+\beta$

Fig. 11. Changes in the Number of Employees by Manufacturing Industries in U.S. and Their Causes (1970–1980)

Section 2. The Developing Countries' Problems and the Role of Advanced Countries

The problems of developing countries can no longer be considered with a simple chart comparing wealthy, advanced countries with developing countries. Wealthy, capital-surplus oil producing countries, which were once regarded as developing countries have come on the stage of the world economy, while, on the other hand, some of the middle-income countries have succeeded in their industrialization. Meanwhile there still exist a number of LLDC countries which are suffering from poverty and low economic growth.

The abovementioned diversification in the economic conditions of the developing countries has made the North-South problem complicated. In this diversified environment, it is necessary for the advanced countries, including Japan, to implement appropriate economic cooperation which meets with the economic conditions of the counterpart countries.

(1) Regarding Official Development Assistance (ODA), the Japanese Government set a new ambitious medium term target of ODA on January 23 of this year, which is very important for Japan. Thus, it is vital for her to expand ODA positively so that the target can be successfully achieved. But it is also necessary to carry out accentuated cooperation of ODA which meets with the conditions and development phases of counterpart countries.

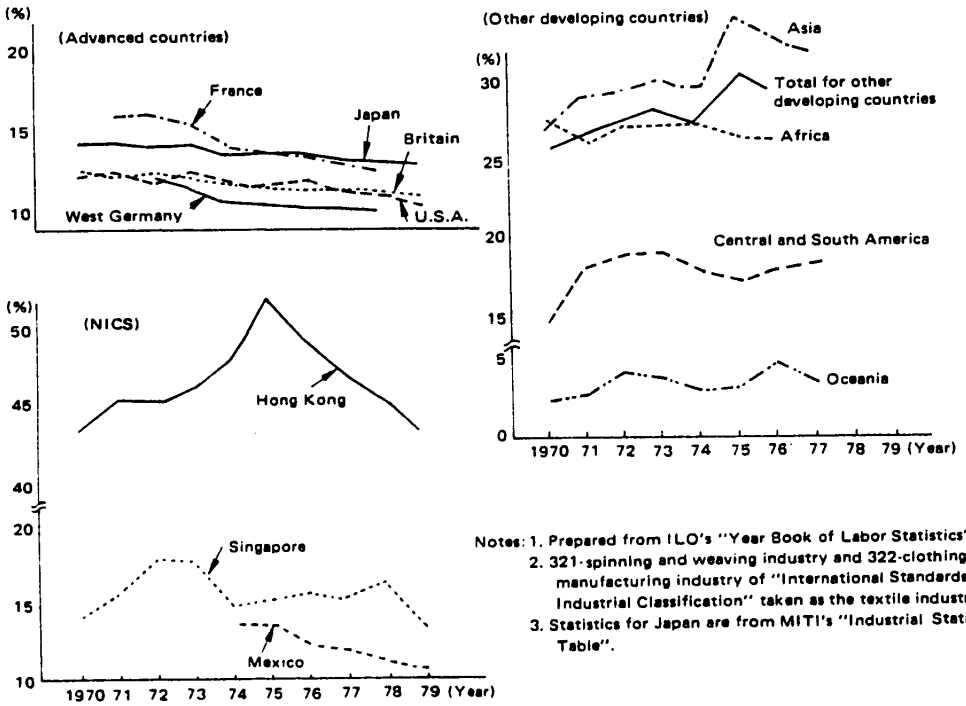
(2) It is necessary to pay careful attention to the smooth recycling of oil money to those non-oil producing countries which are suffering again from enlarged deficits in their current account balances of payments, and also from accumulated international debt under the influence of the second oil crisis.

(3) It is necessary for the advanced countries positively to create opportunities in their domestic markets so that they can promote international trade with those developing countries under industrialization. Those countries which are industrializing are not limited to the so-called New Industrializing Countries (NIG's), but also industrialization is developing in many countries in the sectors of labor-intensive light industries, such as the textile industry. With reference to the share of the textile industry in employment, it displayed an upward trend in many developing countries after the 1970's while it decreased in the advanced countries and the NIC's (Fig.12)

(4) The promotion of direct investment overseas and technology transfer via it to meet the industrialization and other conditions of counterpart countries are necessary.

Section 3. Internationalizing Finance

Along with the expansion in size of the Japanese economy



Notes: 1. Prepared from ILO's "Year Book of Labor Statistics".
2. 321-spinning and weaving industry and 322-clothing manufacturing industry of "International Standards Industrial Classification" taken as the textile industry.
3. Statistics for Japan are from MITI's "Industrial Statistics Table".

Fig. 12. Changes Textile Industry's Share of Employment in Manufacturing Industries

and internationalization of its monetary transactions, the role of Japan in the world money markets will be greater. We have mentioned earlier that the Japanese financial and capital markets are conducting a relatively large role in the field of overseas loans and the supply of money for overseas governments and enterprises. This trend will continue to increase. Especially, Japan's role in recycling oil money to non-oil producing countries is important from the viewpoint of the world economy.

Chapter 4. Better Housing and Leisure Time

Without a vibrant economy, the stability and betterment of people's livelihood cannot be achieved. Livelihood itself, however, is the source of economic vitality. It is a goal of the future therefore both to maintain the economic structure having vitality and at the same time to achieve an affluent level of people's livelihood, thus avoiding the disease of many advanced countries.

Conclusion of Part 2. Searching for the "Vitality to Create and to Exchange", along with the "Vitality to Accept and to Absorb"

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Conclusion

– Vitality to Learn and Creative Vitality –

The Japanese economy has joined the ranks of the advanced countries.

A quarter of a century ago (1955), the United Stages accounted for about one-third of the world's GNP and ranked first in the world. Britain was placed second with 5%, followed by Japan with 2%. In 1977 the United States' ratio dropped to about one-fifth while Japan accounted for 10% of the world's GNP. The various per capita indices in Japan indicate the development of the national economy relative to those of advanced countries.

However, the Japanese economy was a "participant who came late" and was, so to speak a "newcomer". In any social relationship the late participant is beset with difficultiies. First, immense efforts have to be made to obtain the qualification of the participant. Even after participating, it will take time to be treated with camaraderie.

The Japanese economy had a "strong vitality" to learn from the advanced countries of Europe and America. Many people and many enterprises learned. A book entitled "Promotion of Learning", which was written by the late Yukichi Fukuzawa, opens with the famous passage, "God does not create man above man nor create man below man".

Consisting of 17 volumes, it was published over a period of several years from 1872. It is estimated that a total of 3,400,000 copies were printed. Considering that the population of Japan at that time was 35 million, one can understand how popular this enlightening book was.

After World War II, the vitality to learn, based on the "popularization of knowledge", was reborn. The diligence of the elite in Europe and America is well known, but the base of such a class in Japan was wide and the working people as a whole also had a strong desire to learn. And, hand in hand with the "free market competition" principle, the vitality to learn raised the productivity of the national economy and brought about substantial economic growth.

However, the rapid growth of the national economy and Japan's good performance after the oil crisis in 1973 made the advanced countries in Europe and America look at the newcomer and question whether Japan had special features. But was it so?

The annual economic report published by the government in 1976 pointed out that "the confrontation between the two

systems in the world has changed from nuclear armament competition to peaceful competition. Peaceful competition is a struggle to improve the economic growth rate and a contest to raise productivity. We must adapt ourselves, as soon as possible, to the technology of the world which is advancing every day, and to the world environment which will be changed by technological advancement.".

Needless to say, even if technological advancement is for raising productivity, the way it will be done will vary according to the state of affairs in each country. In order therefore to survive the contest to raise productivity in a small country like Japan, it can be said that the national economy, which lacks resources, has chosen rational steps which have the most applicability to make the best use of the country's strength to learn and to compete in world markets.

However, arguing over "special features" and "generalities" is not considered to be productive. Shouldn't it be recognized that all the countries of the world have their own characteristics and are different from each other? After this is recognized, shouldn't learning, which will produce good results regardless of its peculiarity or difference, be regarded as having at its roots high universality? It is believed that "learning" is to find out its own universality and to own it. In this context, the Japanese economy must continue to maintain the "vitality to learn". At the same time, it is hoped that all the countries of the world, particularly the major advanced countries, will have the vision to detect this universality.

Be that as it may, the status of the Japanese economy as a newcomer has changed. The world economy is transforming and shaking violently in the midst of multi-polarization. Under this situation, the Japanese economy is faced with the necessity to solve a number of problems.

First, as a member of the economies of the advanced countries, the Japanese economy has to continue maintaining and increasing the vitality of the private sector. Many of the advanced countries are attempting to reactivate their economies. Thus, the vitality of Japan must not be diminished. Second, the role of the public sector, which cannot be shared by the private sector, must be fulfilled efficiently and fairly. Third, free trade in the world must be safeguarded and the best use of the world economy, including the Japanese economy, must be made. The countries which can explain the benefits of free trade, and are able to share the beneficial results with other countries, have the responsibility to maintain the free trade system. Fourth, the promotion of national life, which is the fountainhead of economic vitality, is an important matter. Therefore, it is especially important to improve the quality of housing and to employ leisure wisely.

In order to solve these problems, it can be said that in addition to the "vitality to learn", "creative vitality" is needed more than reforming oneself and adjusting to others. Not only should the "posture of another person" be taken as a model but also a "posture for oneself" should be created. The basic thinking for this is as expressed in this annual report.

Lastly, we wish to emphasize the following two points as important matters. First, Thomas Jefferson, who was one of the

draftees of the Declaration of Independence of America and was also the third President of the United States, pointed out: "The Government undertakes many projects on the pretext of protecting the interests of the people. However, among these projects there are many which do not serve this purpose. In undertaking projects, the Government is apt to waste the work of the people. It is only when it is possible to make the government eliminate this waste that the people can become happy".

It can be said that the role of the public sector will be fulfilled if it is based on such a viewpoint. Concern is felt about the economic effects of the "administrative reform" which the government is pushing forward. While the real decrease in income resulting from the rise in the price of oil will mean a switchover of Japan's purchasing power to abroad, the curtailment of government expenditure will mean that resources equivalent to the curtailed amount will remain in the private sector. Second, even many of the countries which achieved the status of a major power were not necessarily received with camaraderie when they made their debut in international society and were going through the stages of becoming a major power. By the same token, many of the advanced countries came to be trusted internationally as a result of efforts made by themselves. Accordingly, the Japanese economy, which has grown rapidly, is still in an awkward position internationally. This is unavoidable, but the situation ought to be overcome through national efforts as well as efforts made by everyone in every enterprise at international forums, which are increasing rapidly in number.

CSO: 4120/103

ECONOMIC

POSSIBLE JAPAN TELEGRAPH, TELEPHONE TRANSFORMATION EXAMINED

Tokyo SHUKAN TOYO KEIZAI in Japanese 21 Nov 81 pp 38-42

[Text] The Japan National Railways and Japan Telegraph and Telephone Corporation are drawing attention as possible targets of administrational fiscal reform. Although some say that "it would be senseless for Japan Telegraph and Telephone to be used as a tool in fiscal recovery" (Chairman Oyokawa of the All-Japan Telecommunication Workers Union) it is a fact that inside Japan Telegraph and Telephone and within the Liberal Democratic Party there are rapidly increasing rumblings about changing Japan Telegraph and Telephone from a public corporation into a private enterprise. Policy will be set in the next month or two, and a gigantic enterprise with capital of 1 trillion yen and authorization for another 3 trillion yen may be formed.

On 16 October unprecedented labor-management negotiations were held at Japan Telegraph and Telephone in which, according to Secretary Yamagishi of the All-Japan Telecommunications Workers Union, "when one side proposed, the other side accepted."

Eight people including Japan Telegraph and Telephone's President Shindo and Vice President Kitahara attended for the Public Corporation, while all three members of the Central Executive Committee of the headquarters of the All-Japan Telecommunications Workers Union led by Chairman Oyskawa and Chief Secretary Yamagishi attended on behalf of the union. Under the usual practice in labor-management negotiations at Japan Telegraph and Telephone prior to President Shindo's assuming his office, the president would not have been able to attend labor negotiations. Furthermore, the eight to three ratio is "collective bargaining" is reportedly unique in the history of the talks.

The consultations lasted over 2 hours, and in them a heated discussion developed on the question of turning Japan Telegraph and Telephone into a private enterprise, a question which is directly confronting the public corporation. It was President Shindo who touched off the discussion. He expressed his warm appreciation to the union for "the resolve it has shown thus far."

On 7 October, the All-Japan Telecommunications Workers Union drafted a resolution in preparation for the 34th meeting of its Central Committee. The resolution contained the statement: "We are opposed to conversion to private enterprise, but in such areas as data communications, the basics for competition should be actively adopted." This was unanimously adopted on 12 October.

Labor unions in the public corporations have a strong inclination toward maintenance of the status quo, and it is rare that one of them would go so far as to actively change its own working conditions by advocating introduction of the principle of competition. President Shindo applauded the position taken by the All-Japan Telecommunications Workers Union.

In fact, President Shindo said: "The resolution is written in jargon but, if I read between the lines, it considerably overlaps my own thinking. I am, rather, put at ease about the union which opposes everthing; I consider it has shouldered its responsibility."

In the course of his remarks, President Shindo, speaking soberly about the current situation of Japan Telegraph and Telephone, said: "If we were in the private sector, we would be near bankruptcy." The union side pressed him on this. It said: "You will unduly upset the membership. Withdraw that remark."

President Shindo bowed his head, but then he broke in saying: "Very well, but let me say something". The "collective bargaining" suddenly became a very quiet one-man show.

"It is impossible to achieve what the union is asking for unless we get free of national budgetary controls. No matter how large Japan Telegraph and Telephone may be, it is still part of the state apparatus. It cannot be excluded from the across-the-board regulations which give it the same status as the administrative agencies and offices. The situation might be different if we could operate according to the Public Corporation Act, but it is impossible to achieve the union's desires while we are completely tied up by strong administrative directives and legislation which supersedes the Public Corporation Act. It is a matter of using the situation, with its fiscal shortfall and extraordinary board of inquiry, to get free of the confines of national budgetary controls."

Suddenly the question had been raised. Japan Telegraph and Telephone is the star performer of the three public corporations and five government enterprises. In 4 years it contributed 480 billion yen to the government, and it did this while lowering telephone rates. The question of converting to private enterprise, which had been smoldering in Japan Telegraph and Telephone, burst out all at once at a "collective bargaining" session.

After the collective bargaining session, a second hearing was held in the fourth working group of the special administrational board of inquiry (with Professor Hiroyoshi Kato as chairman of the group). At the hearing, a member of the Mass Communications Committee said: "Still, Japan Telegraph and Telephone is one of the public enterprises. Is it not appropriate for it to have the same status?"

In a forceful voice, bristling with anger, President Shindo retorted: "The workers knock themselves out and get no reward for their effort. Would this be allowed in the private sector? If you were part of Japan Telegraph and Telephone, what would you do?" The All-Japan Telecommunications Workers Union was delighted to hear of this incident. They said: "The old man (this is what President Shindo is called in the All-Japan Telecommunications Workers Union) will not be shut up now." All at once appreciation for Shindo grew, and both labor and management began all at once to agree to their basic perception of the issue of making Japan Telegraph and Telephone a private corporation.

Secretary Yamagishi of the All-Japan Telecommunications Workers Union said: "In the earlier proposal we suggested that the corporation would have a monopoly over circuits but would compete with the private sector in services as such. Speaking as a citizen and in light of the way times are changing, it would not do for the corporation to sit back and do nothing in the current situation. The corporation, however, has developed a policy of private sector management in the form of ownership by the people, and it would be strange to convert to private ownership a common asset of the citizens of the nation which includes property worth more than 9 trillion yen. In the last analysis, public ownership must be a prerequisite."

In saying this, Secretary Yamagishi was using the argument for having the form of a public corporation to put on a show of opposition to a shift to the private sector; however, since his position as secretary ultimately makes him responsible for an organization of 290,000 union members, considerable political allowance must be given to statements he makes.

In fact, Secretary Yamagishi is flexible; he said: "President Shindo said he would prepare a response on the question of private management in February, but an answer will develop in the next three or four sessions if there is give-and-take between management and labor."

Chairman Oyokawa also has somewhat decided views on the matter. He said: "It will be necessary to have a system in which shares cannot be bought up by certain shareholders such as large firms. It will be necessary to look at the European system of special citizen's shares, etc., as reference in studying how to devise a public conversion to private management and how to realize the capabilities of those involved. It will be necessary to study various methods such as open accounting and a checking structure composed of users."

The All-Japan Telecommunications Workers Union seems to be ready to make a decision on the question of private management as early as 12 December. Although the simple term private management is used, various formulas such as completely private management or a third sector arrangement could be considered, but in view of the public nature of Japan Telegraph and Telephone, both labor and management have ruled out completely private management. Therefore, the option becomes a third sector formula of private management answerable to the public.

Furthermore, the Tanaka faction of the Liberal Democratic Party, which has very great influence on the Ministry of Posts and Telecommunications and the All-Japan Telecommunications Workers Union, is said to be encouraging the change; Diet member Kakuei Tanaka himself has reportedly said: "Go ahead with the shift to private management."

Chairman (Hiroyoshi) Harada of the Liberal Democratic Party "Subcommittee on the Telegraph and Telephone Enterprise" has also hinted at approval of private management. He said: "Even within the Liberal Democratic Party there are people who come from the bureaucracy and have the view that things are probably all right as they stand. Because of my position I cannot give my private views, but an organization which cannot reward people for working hard should not be all right. On top of that, under the current circumstances, Japan Telegraph and Telephone, which is working toward a highly informational society, cannot be expected to make full use of its capabilities."

Movement toward private management is gaining strength within the public corporation and among those outside the corporation who are concerned with the question.

The interim report of the special board of inquiry will be given at the end of July next year, but it seems as though the conclusions of the fourth working group which will handle the question of Japan Telegraph and Telephone will be made before that and will be released as early as the end of March. The issue of converting Japan Telegraph and Telephone to private management will come to a head quickly in the next month or two.

Even so, the characteristics of a functionary are said to be persistence, regular attendance and not doing any work. One cannot say that all 330,000 employees fit this description, but it is a fact that there are many employees of public corporations who are enjoying a warm bath in a full tub. Away from Tokyo, to be an employee of Japan Telegraph and Telephone is to be elite. The employees cling to their Japan Telegraph and Telephone badges, and salary levels are high for those outlying areas.

There are managers in the prefectures who openly declare: "With a change to private management, things would get tougher and salaries would go up, so rather than that, it will be just fine to have a public corporation as we have now." Many of the young technicians at the communications research center sing the praises of the "paradise" at Japan Telegraph and Telephone. They say: "If private management were to come about, cost controls would become strict and research themes would naturally be subjected to selection or rejection. Japan Telegraph and Telephone would lose its appeal if the free research system which has existed so far were to change."

According to Director Kojima of the corporation's Personnel Division: "The majority of the 330,000 employees think that since they are gradually becoming poorer under the current situation, some sort of changes will have to be made. However, when it comes to approving a change to private management, only about 30 percent will agree."

Nevertheless, if the current situation is allowed to continue, various problems which will determine the fate of these 330,000 employees will arise in as little as 4 to 5 years. These problems could make the corporation lose its drive as an organization and invite a weakening of its fiscal base. Japan Telegraph and Telephone, the star performer, could become another Japan National Railways. This is the background for the switch to private management.

At present, the budget and the general provisions wirtten into the budget document, the Public Electricity and Communications Act, the Japan Telegraph and Telephone Public Corporation Act, and strong administrational direction from the Ministry of Posts and Telecommunications have Japan Telegraph and Telephone completely tied down.

The system of general budgetary rules, in particular, has an effect which is equivalent to virtually depriving the public corporations of a self-supporting system of operation. One example of the regulations under the Public Corporation Act is that while a private enterprise can apply excess funds to stocks, bonds or savings, in Japan Telegraph and Telephone's case, all excess funds are deposited in the Bank of Japan. (Currently these deposits are 200 billion yen.) No interest is paid on the first 3 billion yen. Beyond that amount, interest is paid at the rate of only 3-4 percent.

The greatest restriction is that Japan Telegraph and Telephone has absolutely no power to set wages independently. Currently, complete implementation of the rulings of the Public Corporation and the National Enterprise Labor Relations Commission in arbitration on raising the basic level of government employees' salaries has become a political issue which is bound up in administrational reform; Japan Telegraph and Telephone, as is to be expected, has also been drawn into this issue. This is a public corporation which even in the high growth sector of communications and information has somehow lowered its rates and still contributed 480 billion yen to the state.

Considering that Japan Telegraph and Telephone is a company with 1 trillion yen in capital, it would seem that it is a company which over the next 4 years could pay dividends of 10 percent in two installments. When the shareholder, which is the state, gathers up all of the dividends and then says, in regard to wages: "Since the workers have the same status as public servants, full implementation...," it is not unreasonable that there are cries of "foul play."

Furthermore, before 1975, when the corporation made a contribution, Japan Telegraph and Telephone was experiencing the most difficult period since its founding in 1952. With the demand for telephones increasing, the difference between income and expenditures was 2 percent per year and there was a deficit of 80 million yen. Redemption of Japan Telegraph and Telephone bonds peaked at about 60 million yen per year, and coverage of this debt at somewhat more than 10 percent of proceeds put tremendous pressure on Japan Telegraph and Telephone's fiscal affairs.

Since the average rate of financing for a firm in the private sector is around 3-4 percent, how strong this pressure was can probably be imagined.

As immediate measures to deal with this situation, the corporation developed policies of rationalization which would not be considered commonsense in a public corporation. It took steps to eliminate the deficit mainly by holding down the number of its personnel (a reduction by 81 persons was included in the draft budget request for 1982, the first such reduction since the inauguration of the corporation) and constricting capital investment (20 million yen).

The reality is that even after making contributions and implementing rationalization, the reward is "equal status" with such entities as Japan National Railways, which is in the red.

If such a situation continues it is probably inevitable that working seriously will be considered foolish. Eventually the organization's drive will be lost and, along with a deterioration of the fiscal base, a "crisis at Japan Telegraph and Telephone" will develop.

To cope with peak demand for telephone service, Japan Telegraph and Telephone under the leadership of Vice President Kitahara is moving foward with the concept of an INS (Information Network System). As nontelephone services such as computer-associated date communications facsimile and video communications develop, it will be the INS which will facilitate exchange of these kinds of information.

Japan Telegraph and Telephone's aim, backed by the use of digital communications and optic fibers, is to build a huge demand by eliminating the distance differential and at the same time to strengthen its fiscal base by greatly cutting costs. The INS is Japan Telegraph and Telephone's ticket to a new lease on life.

Currently, the distance differential for the telephone is 1:60. Since this should shrink to 1:5 or 1:6 in the coming years, demand will probably begin to increase again. Already, the differential for facsimile is only 1:1.5. The effects of technological innovation are already beginning to show.

On the other hand, with the introduction of digital communications, it seems that a personnel surplus of more than 100,000 persons will occur in 10 years. However, these excess personnel cannot smoothly and efficiently be put to new use through spinoff, etc., within the present framework of the public corporation.

The best electronics and communications research center in the world is at Japan Telegraph and Telephone. The center has more than 3,000 people and spends nearly 60 billion yen a year on research and development. It has taken the lead in Japan's technological revolution in the field of electronics.

In the fields of super LSI, optic communications and digital communications in particular, Japan Telegraph and Telephone boasts the world's most advanced technology. This is true to such an extent that for the past 10 years IBM itself has been seeking to conclude a cross license agreement. A contract on this will be signed, possibly this week.

However, unless the Public Electronic Communications Act and the Public Corporation Act are revised, it is impossible to extend this highly advanced technology to other areas of industry and to use it extensively in commercial activities.

In short, as long as Japan Telegraph and Telephone is subject to budgetary controls and other such laws and is subject to administrative direction, it will not, struggle as it might, break clear of the danger it faces even as it makes progress. Even its ace in the hole, the INS, is premised upon the employees' industry and will to work and upon a stable fiscal base. There is no way to break clear of these restricting conditions except conversion to private management, whether it is as a third sector or as official private management.

What, then, if Japan Telegraph and Telephone does convert to private management? Its proceeds are over 4 trillion yen; profit (difference between income and expenditures), 388.1 billion yen; total capital, 9.4591 trillion yen.

The only enterprise which can rank with this is the public untilities corporation of Tokyo Electric Power. By comparison with Tokyo Electric Power, it would probably be appropriate for Japan Telegraph and Telephone's capital to be 1 trillion yen and its authorized capital to be around 3 trillion yen.

Breathing a heavy sigh, President Hiragishi of Tokyo Electric Power said: "Up to now Tokyo Electric Power has been the only giant. If an even larger enterprise were to appear, I would be as confident as possible but, from the viewpoint of capital procurement and other aspects of corporate operations, I think 1 trillion yen would be the limit as far as Tokyo Electric Power is concerned. If the corporation were to start with 1 trillion yen, well...."

President Shindo has said: "We will not use the KDD formula." Therefore, the state would probably hold about half of the capital and the remaining half would probably be divided among small stockholders with stringent restrictions on its acquisition.

Furthermore, although the move would be called a switch to private management, the public service character of the corporation and guarantee of security in time of emergency could not be maintained unless the circuit network were placed under the control of the state. On top of this, assuming a shift to an approval system parallel to the one for Tokyo Electric Power for questions involving rates and so forth, the current management commission would probably have to be reorganized to include subscribers, employees, the government and management and to have stronger oversight authority.

The leader of a certain securities firm pointed out the tremendous effect a changeover would have. He said: "If Japan Telegraph and Telephone goes public and half of 1 trillion yen, or 500 billion yen, is absorbed by the public, stocks across the board will slump."

Furthermore, capital investment to realize the INS as well as for the other purpose would have to continue at 1.6-1.7 trillion yen per year. Procurement of capital will naturally be a major theme.

Even if the corporation were to change to private management, there would be a limit to what it would be able to procure by relying on government guaranteed bonds (Japan Telegraph and Telephone Bonds). Therefore, "company bonds" issued independently by the company, similar to the current "Special Japan Telegraph and Telephone Bonds," would be necessary. Just 2 or 3 years ago, Tokyo Electric Power issued 40 billion yen worth of company bonds every month for a year; procurement of capital in excess of this amount would cause heavy repercussions in government and other bond issues.

Furthermore, if the corporation were to issue company bonds, it would have to increase its own capital. If a corporation with 1 trillion yen in capital increased its capital by even 10 percent at face value, it would draw off 100 billion yen from the market. Total capital increases this year amounted to a little more than 1 trillion yen. Thus, one capital increase would draw off 10 percent of the money. There certainly would be a commotion as though a mammoth had come into a pond.

On the other hand, after the switch to private management was realized, would the union remain solely with the General Council of Trade Unions of Japan, the Sohyo, which adamantly opposes changing public corporations over to private management? Especially since this involves the All-Japan Telecommunications Workers Union, which is the largest and most rightwing oriented union in Sohyo, conversion of Japan Telegraph and Telephone to private mangement would probably cause great repercussions on the labor front.

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ECONOMIC

TOYOTA MOTOR WORKS OUT BULLISH PRODUCTION PLAN FOR '82

Tokyo JAPAN ECONOMIC JOURNAL in English Vol 19, No 986 22 Dec 81 p 3

[Text]

Toyota Motor Co. and Toyota Motor Sales Co. last Tuesday announced their business plans for 1982, in which the nation's No. 1 automaking group set their new production target 5 per cent higher than this year.

The production goal of Toyota Motor and its sales arm for the new year is 3,380,000 units (excluding knockdown kits for overseas assembly), compared with an estimated 3,220,000 for this year.

Toyota said it expects its exports in 1982 to go almost crabwise at about 1,730,000 units in view of the stricter export environment.

Conversely, the company is bullish toward domestic sales, which it estimates will climb by 10 per cent to 1,650,000 units. Behind the optimistic outlook on domestic sales is the reduction of the official discount rate enforced by the Bank of Japan and the Government from December 11.

Toyota policy makers believe the bank rate cut will lead to improving corporate profits at large and cause a pickup in both corporate and individual demand. They also hope that unveiling of new cars and restyling of existing models will pump in fresh demand in the new year.

Here is the gist of Toyota's outlook on the auto business trends in Japan in 1982:

Domestic sales: Aggregate demand for automobiles at home in 1982 will increase to 4,200,000 units (excluding midget vehicles), the second highest next only to a record 4,290,000 scored in 1979. (Toyota initially estimated domestic demand in 1981 at 4,100,000 units and 50,000 units more or less, but it will actually remain at some 3,900,000.)

One factor underlying the bullish view is the rebound of passenger car sales which began to go over the year-earlier level from around September. The other is an anticipated upturn of truck sales stemming from the money rate cut and a resultant business recovery.

Toyota has a target to sell 2 million passenger cars, trucks and buses at home in 1985. As a step to attain the ambitious goal by stages, the company must annually sell its vehicles at a pace swifter than the growth of aggregate demand. Toyota thus expects its share in the domestic market to reach 39.3 per cent in 1982 after hitting 37.3 per cent in 1980 and 38.5 per cent in 1981.

When midget vehicles are included, aggregate domestic demand in the new year will run to 5,480,000 units, compared with an estimated 5,130,000 for this year. In this case, Toyota wants its share in the domestic market to rise to 30 per cent in 1982 from this year's 29.2 per cent.

Exports: Overseas sales in 1982 will move almost sidewise or rise marginally by 1.2 per cent over a year earlier. Shipments to the U.S. and some European nations in 1982 are due to be voluntarily curbed as in the preceding year. Toyota will have to try to boost exports to developing countries and elsewhere with scrupulous efforts to cultivate fresh demand. The company will next year increase production of KD kits by 30,000 to 140,000.

When KD kits are included, the projected production of the Toyota group in 1982 will reach 3,520,000 units against the 3,330,000 estimated for 1981.

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ECONOMIC

INDIGENOUS COMPANIES JOIN FORCES AGAINST AMERICAN TAX

Tokyo JAPAN ECONOMIC JOURNAL in English Vol 19 No 987, 29 Dec 81 p 5

[Text]

Kyoto Ceramic Co., Matsushita Electric Industrial Co., Sony Corp. and others have decided to organize a plaintiff group for opposing the unitary tax in the U.S. in relation to the start of proceedings in the U.S. Supreme Court shortly on a case against the tax raised by an American company.

Chicago Bridge & Iron Co. of Oak Brook, Ill. filed a suit with the Supreme Court on testing the legality of the tax from its view that the tax violates the principle of fair taxation set in the U.S. Federal Constitution. In the U.S., multinational enterprises, such as International Business Machines Corp. and Coca-Cola Company, support the Chicago firm and have organized plaintiff groups.

In Japan, opposition to the tax is on the rise on the grounds that it imposes a dual tax on Japanese and other foreign enterprises in the U.S. and it obstructs smooth commerce between Japan and the U.S. as well as obstructs investments in the U.S.

Thirty-six firms in the Kansai (Osaka-Kyoto) area, including Kyoto Ceramic and Matsushita, became the first in forming a council for considering measures against the unitary tax, and the Federation of Economic Organizations (Keidanren) in Tokyo followed by adopting a resolution against the tax.

The Kansai Economic Federation (Kankeiren) directly has appealed to the states using the unitary tax swiftly to abolish the tax, and also has drawn up a resolution asking the Japanese Government to take effective diplomatic actions.

Kyoto Ceramic and others now plan to send a large plaintiff group to the U.S. to oppose the tax in relation to the coming Supreme Court examination of the case.

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ECONOMIC

STRONGER HOME DEMAND, SLOW GROWTH FORECAST FOR FY '82

Tokyo JAPAN ECONOMIC JOURNAL in English Vol 19 No 987, 29 Dec 81 p 5

[Text]

The Japanese economy in fiscal 1982, starting next April 1, is likely to continue to gradually recover, but ingredients of growth will be somewhat different from fiscal 1981. First, exports will be growing at a lesser pace because of intensifying trade frictions. Second, fiscal policy will be playing a minor role due to budgetary constraints. On the other hand, however, stability of prices will favorably affect personal consumption and, consequently, will lead to recovery of capital investment by smaller enterprises. Fiscal 1982 economy thus will be characterized by a stronger domestic demand than in fiscal 1981, although the economic growth rate as a whole will remain almost the same at slightly over 3 per cent. The current-account surplus, meanwhile, is expected to continue to run a huge surplus.

Economy in 1981

Japan's real GNP growth in 1981 registered 3.0 per cent in the first quarter, 4.8 per cent in the second quarter and 2.4 per cent in the third quarter, respectively, from the preceding period. These figures attest to a moderate expansion of the economy.

Prices continued basically stable throughout the year. Advances of wholesale prices remained slow, leading to an equally calm movement of consumer prices, which also benefitted from moderate rises in labor cost. In November, wholesale prices stood at 1.6 per cent and consumer prices (in Tokyo) 3.9 per cent ahead of a year earlier.

In the balance of payments, trade balance kept running a huge surplus each month due to strong exports of machinery and slow imports of raw materials. The current-account balance as a result turned into the black in the second quarter, averaging $660 million at a monthly rate, which grew to $780 million in the third quarter, and $1,500 million in October.

Despite these seemingly favorable performances compared with other industrialized economies, the Japanese economy in the past year was not necessarily in perfect shape.

First of all, its expansion depended primarily on external demand in the absence of strength in personal consumption and corporate capital investment. Of the real growth rate of 3.4 per cent during the first nine months of the year, 2.6 per cent was attributable to exports and other overseas surplus, with domestic private demand accounting for a mere 0.06 per cent.

Second, last year's business recovery was imbalanced. Inventory adjustment in assemble-type industries progressed generally smoothly, but that in industries producing basic materials lagged. Capital investment by big corporations was strong, but that by smaller enterprises was contrastingly weak. Imbalances also persisted among different geographical regions.

Corporate results reflected such a sluggish recovery, with pre-tax recurring profits recording a sharp 19.4 per cent drop in the six months to September, 1981, from the preceding six months.

External environment for fiscal 1982 economy

With the U.S. and European economies likely to remain in the doldrums in 1982, there seems little likelihood of a sharp markup on crude oil. Japan's import price of crude in fiscal 1982 is expected to average $38 a barrel on a c.i.f. basis, up 1.9 per cent from fiscal 1981.

Domestically, given the mandate for fiscal rehabilitation through reduction of debt-financing bonds, fiscal policies will play a severely restricted role in the new fiscal year's economic management. Following the December 11 discount rate cut by 0.75 percentage point, money is likely to remain relaxed.

Shape of fiscal 1982 economy

The Japanese economy looks likely to keep on a gradual recovery path, but factors for expansion will be somewhat different from those of the past year.

Exports, which served as a driving force in the past year's economic recovery, will slow down sharply in the growth rate — perhaps to 4.5 per cent over fiscal 1981. Reasons for the slowdown are the lagging recovery of world economy, rising trade frictions with other industrialized countries suffering from high unemployment, and decline in competitiveness of Japanese products owing to appreciation of the yen.

The size of the fiscal 1982 national budget offers little hope for a role to be played by fiscal expenditures. Public works investment, in real terms, in particular, is scheduled to be cut back from the current fiscal year's level, resulting in a decrease of 3 per cent or so in public fixed capital formation on the GNP statistics basis.

Private domestic demand, on the other hand, looks likely to grow faster than in fiscal 1981.

As for private final consumption expenditures, wage raises to be negotiated in the coming spring round will likely be smaller than last year's 7.7 per cent (as surveyed by the Labor Ministry). This projection is based on the recent slowdown of corporate earnings and a low rate of inflation.

On the other hand, the expected gradual recovery of business will result in a higher increase in overtime worked and bonuses, and improvement in employment situations, while independent businesses will also fare better. All these trends will work to boost personal income at a faster pace than in fiscal 1981.

As a result, private final consumption expenditures will record an increase of 7 per cent or so before inflation, slightly higher than in fiscal 1981. With consumer price advances expected to remain moderate, consumption expenditures after inflation will rise by about 3 per cent, up sharply compared with 0.3 per cent for fiscal 1980 and an estimated 1.1 per cent for fiscal 1981.

As for housing, the worst will be over in the new fiscal year, but for a variety of inherent reasons, including land prices, the recovery will be a modest one, with the rate of increase

Outlook for Gross National Expenditures

(Year-to-year percentage changes, seasonally adjusted figures in parentheses)

	FY 1980	FY 1981 (provisional)			FY 1982 (estimate)		
			1st half	2nd half		1st half	2nd half
Gross national expenditures (nominal)	7.7	5.9	(5.3)	(6.8)	6.6	(6.4)	(6.6)
Gross national expenditures (real)	3.7	3.3	(3.7)	(2.6)	3.1	(3.1)	(3.4)
Domestice private demand	0.5	0.6	(0.4)	(2.4)	3.7	(4.3)	(3.9)
Private final consumption expenditures	0.3	1.1	(0.9)	(2.4)	3.0	(3.3)	(2.9)
Private housing investments	—10.1	1.6	(11.2)	(—4.6)	4.9	(9.8)	(5.3)
Private plant and equipment investment	5.7	1.1	(—0.4)	(3.2)	4.6	(5.2)	(5.0)
Private inventory investment	—3.9	—47.4	(—68.7)	(70.4)	43.2	(25.5)	(53.7)
Public expenditures	0.2	3.2	(2.3)	(2.0)	—0.6	(—1.8)	(—0.7)
Government final consumption expenditures	2.7	2.7	(0.2)	(4.0)	2.0	(0.5)	(3.0)
Public capital expenditures	—2.1	3.7	(4.5)	(0.1)	—3.1	(—4.1)	(—4.4)
Current overseas surplus	247.6	50.3	(67.2)	(6.9)	5.9	(3.9)	(9.0)
Exports etc.	16.6	16.6	(27.6)	(1.5)	4.5	(4.8)	(6.9)
Imports etc.	—3.9	5.7	(14.3)	(—0.9)	3.8	(5.2)	(6.0)
Mining & Manufacturing production (reference)	4.6	4.1	(2.7)	(8.8)	5.4	(4.0)	(5.0)

stopping short of 5 per cent in real terms.

Private capital investment which slumped in fiscal 1981 owing to sluggishness in spending by smaller businesses, is expected to pick up in fiscal 1982 as domestic private demand will stage a moderate recovery, leading to reinvigoration of smaller businesses' investment. Investment aimed at new product development and higher efficiency remains strong in the meantime. All in all, private capital investment in fiscal 1982 will rise by 4.6 per cent in real terms.

As for private inventory investment, considerable progress in adjustment has been seen in basic materials industries, such as petroleum and coal products, and paper and pulp, where inventory hangover was heavy. In the new fiscal year, moves for inventory buildup, if moderate, will show up as final demand picks up.

Overall, prospects for the economy in fiscal 1982 are for a nominal GNP growth of 6.6 per cent, up from 5.9 per cent estimated for fiscal 1981. After inflation, however, the growth rate will be 3.1 per cent, which is even lower than the projected 3.3 per cent for fiscal 1981. The Government's projection of a 5.2 per cent real growth in fiscal 1982 is hardly achievable.

Prices

Wholesale prices are expected to maintain a calm trend in the new fiscal year due to stable overseas commodity prices with a basically strong trend of the yen in store. Their advances during fiscal 1982 will average 1.8 per cent, compared with 1.4 per cent for fiscal 1981. Consumer price advances will also be moderate, with fiscal 1982 average expected to register 4.2 per cent or so.

Balance of payments

Japan's exports in fiscal 1982 will reach $167 billion, up 9.2 per cent from fiscal 1981, and imports $137 billion, up 7.6 per cent. Trade surplus will thus be $30 billion, resulting in a current-account surplus of $12.5 billion.

According to the DKB's outlook, fiscal 1982 economic growth at 3.1 per cent is to fall short of 4 per cent for the third consecutive year. (The three years' average will be 3.3 per cent). In the aftermath of the two oil crises, the Japanese economy appears to have come closer to a slow-growing and matured type of economy like other advanced countries of the West. The most important challenge facing Japan in fiscal 1982 is adjustment to such a slowdown in growth. For one thing, this will require thorough elimination of budget and administrative wastes. Another requirement will be continuous efforts for strengthening corporate resources — technologically, financially and otherwise.

Another task facing Japan is to smooth out its trade relations with the U.S. and West Europe which have been badly strained owing to the sharp rise in Japan's exports and sluggish imports. With Japan's share of the international economy growing steadily, maintenance of harmony with the rest of the world is essential to secure its stable growth.

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ECONOMIC

HITACHI, EUROPE TIE ON INDUSTRIAL ROBOT SALES

Tokyo JAPAN ECONOMIC JOURNAL in English Vol 19 No 987, 29 Dec 81 p 7

[Text]

Hitachi, Ltd. next year will promote exports of industrial robots to Europe under its recent sales agency contracts with Britain's Lansing Bagnal, West Germany's Zeppelin-Metallwerke and France's Martin & Cie.

Under the sales tie-ups, Hitachi will supply its welding, painting and other robots to Martin and Zeppelin-Metallwerke for distribution in their respective countries. Martin is a machine tool sales company, and Zeppelin is a major maker of chemical equipment and wireless apparatus.

The tie with the German firm may develop into a broader link, including technological know-how or/and more comprehensive business lines.

Lansing, a top construction machinery builder, has already received sample shipments.

Hitachi thus hopes to export 350 robots in 1982, including 120 for Europe and 100 for two U.S. enterprises, compared with an estimated 180 in 1981.

The two U.S. firms are General Electric Co. and Automatix, Inc., with which Hitachi has been in overall business ties on robots.

In addition, Hitachi has been negotiating with 10 other foreign enterprises, including Britain's General Electric, to tie up on robot sales or related skills. Approaches to Hitachi have come from Sweden, Finland, Switzerland, Belgium, Austria, the Soviet Union and some East European countries.

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ECONOMIC

NISSAN MORE CAUTIOUS THAN TOYOTA IN 1982 BUSINESS PLAN

Tokyo JAPAN ECONOMIC JOURNAL in English Vol 19 No 987 29 Dec 81 p 7

[Text]

Nissan Motor Co. appears somewhat cautious, compared with Toyota Motor Co., in predicting business trends in 1982.

The nation's No. 2 automaker announced its business plans for 1982 in late December, in which it set the new year's production goal at 2,678,000 units, up 3.7 per cent from 1981, compared with the 5 per cent growth targeted by No. 1 Toyota. Nissan also plans to produce 284,000 knocked-down kits for overseas assembly, up 25.1 per cent.

Nissan envisions boosting its domestic sales in 1982 by 7.2 per cent to 1,226,000 units against the 10 per cent increase set by Toyota (JEJ Dec. 22 issue, Page 8).

As for aggregate demand at home, Nissan estimates it at 4,100,000 units, up 5 per cent, while Toyota puts it at 4,200,000, up 7.7 per cent.

Also in setting new export goals, the two biggest automakers were split in their views, though marginally. Nissan expects its exports in the new year to rise by 1.0 per cent to 1,452,000, anticipating that 1981 exports will fall by 1.9 per cent to 1,438,000. The comparable export growth rate targeted by Toyota for 1982 was 1.2 per cent.

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ECONOMIC

DOMESTIC DEMAND RECOVERY SEEMS UNCERTAIN PROSPECT

Tokyo JAPAN ECONOMIC JOURNAL in English Vol 19 No 987 29 Dec 81 pp 1,16

[Article by Masahiko Ishizuka]

[Excerpt]

As 1981 gives way to 1982, the Japanese economy continues to be caught in a trap with no easy way out in sight, with weakness in domestic demand presenting the nation's economic managers with the most knotty problem.

Just a year ago, the Government came up with an outlook which put fiscal 1981 real economic growth rate at 5.3 per cent. As the year progressed, however, it was forced to revise the projection downward twice — to 4.7 per cent and then to 4.1 per cent. The original outlook stood out for its overt optimism, compared with most of the projections by private institutions anticipating a growth rate in the neighborhood of 4 per cent.

The Government's relative bullishness a year ago was based on an assumption that consumption would revive on the strength of slowdown of advances of prices. But things have not come out that way. Despite the success in controlling inflation, private final consumption expenditures continue sluggish, turning out to be the prime culprit for the slower-than-expected economic growth in fiscal 1981 as in 1980 fiscal.

Again, the Government's projection for fiscal 1982 stands out for an unmatched optimism — a 5.2 per cent real economic growth which compares with most private institutions' forecasts falling in the 3-4 per cent range. And the assumption is again the same as a year ago — a stronger domestic demand like personal consumption and housing.

Policy targets receiving top priority are also the same as a year ago — 1) alleviation of trade frictions arising from Japan's heavy dependence on exports; and 2) reduction of budget deficit.

Will the new year be able to fare better, learning lessons from the past year's performance? As many economists point out, the prospects are not quite bright.

The Government expects that, and most private forecasters agree to a varying extent, that personal consumption expenditures will revive in the coming year on the strength of increases in overtime worked and bonuses, while prices remain calm. Some question this assumption, however, citing the prospect that wage increases in 1982 to be negotiated in the spring labor offensive will average less than in 1981. (The Government itself foresees this possibility.) Also tax and other non-consumption expenditures will continue to account for an increasing proportion of workers' income in the absence of personal income tax cut, which is absolutely ruled out at a time when reduction of fiscal deficit is a sacrosanct policy objective. Disposable income therefore is expected to continue to sag.

Housing investment is projected by the Government to grow by over 10 per cent in fiscal 1982, compared with this fiscal year's 0.9 per cent. This assumption is most seriously challenged in the light of absence of any effective measure to speak of. The recent lowering of the Bank of Japan discount rate, for example, is having no impact at all on the cost of housing finance by commercial financial institutions.

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SCIENCE AND TECHNOLOGY

TECHNOLOGICAL PERSPECTIVE FOR 1980'S REVEALED

Tokyo TECHNOCRAT in English Vol 14 No 8, Aug 81 pp 11-15

[Article by Shuji Tamura, director, Electric Standards Division, Agency of Industrial Science and Technology, Ministry of International Trade and Industry]

[Text]

1. Characteristics of Japanese Technological Development

1-1. Industrial Structure and Technology

Economic growth in postwar Japan has been making progress, making full use of the open economic system, that is to say importing necessary raw materials and exporting manufactured products. At the same time, the Japanese economy has been adapting itself optimally to the world economic development, making shifts from using coal to oil, from inland locations to coastal locations, from small-scale to large-scale plants with great mass-production effects. Japan generally owes its economic success through this adaptation and to the high stability of the world economy in the 1960's continuing into the first half of the 1970's, closely linked with stable international currencies as a prerequisite to trading and increasing supplies of energy and resources. It is important from a technological point of view that the postwar period was the flowering time of technological innovation in the mass market symbolized by the mass-production of automobiles and electronic home apliances such as televisions and radio sets.

These circumstances have molded Japan's technological developments into "end products types" or "downstream types" which make much of markets, with tendencies toward limited technological developing capacity in respect of the supply of energy and raw materials essential to production. From an international point of view, such countries as the U.S., West Germany, Britain and France show, even today, high percentages of self-sufficiency in energy and raw materials, having a lot of domestic energy and resource industries, at home. In contrast, Japan has looked down at the coal industry as a declining industry, while instead

cherishing the oil refinery industry even without having domestic oil fields, resulting in unsuccessful fostering of energy intensive industries equipped with adequate power of technological development for securing new energy sources. This weakness can be visualized quite well in the fields of energy and resources development. In new oil fields under development, most excavators and gigantic machines are either American or European made. More important is the fact that know-how for resources development has almost been fully monopolized by specialized companies of Europe and the U.S. Japan's present situation might be the natural outcome of a country, sparce in resources, but it seems necessary for the country, as one of the largest consumers of energy and resources in the world, to make intensive effort at technological development in these fields.

Another prominent feature of the present industrial structure is that Japan has been growing on an economy primarily of civil products. Because technology for defense and military equipment is often required to show high performance in very special environments, the technology developed cannot readily be applied as it is in other fields. However, its effects on space development, and the aeronautic and electronic industries are not negligible. Usually the research and development of technology for defense and military equipment gives first importance to performance while giving little head to cost, resulting in the effect of widening the frontiers of technology in specific fields. On the contrary, the research and development of civil products, is much limited by cost, confining the pursuit of performance within cost limits. Consequently, techniques produced in Japan tend to show good cost-performance balance, though somewhat lacking in technological creativity. In use the tend, to be multifarious and highly applicable because of efforts to make full use of available techniques which contribute to reducing substantial development time and costs.

Table 1, which shows finance for technological development in major industrial countries, show clearly Japan's uniqueness of small government finance for R&D. It shows, that while the Japanese government shoulders an extremely small 1% of the expenses for research and development carried out by industry, American and British governments provide more than 20% of such expenses, and that this difference applies primarily to such sectors as aircraft, and electronic and electric machines. At that period, the research and development related to energy is not amply budgeted, the role of the government and universities in each country seems to have been underestimated as compared with today.

In Japan, smaller businesses are generally at high levels of production technology and support large companies primarily engaged in the assembly and production of final products, by supplying parts and subcontracting simple or standardized machining processes. This is particularly prominent in the machining and assembling industries, such as the machinery industry and durable consumer goods industry. However

some industrial sectors such as the chemical industry is not merited by the subcontracting system because of the continuous manufacture up to final products using integrated processes. In the process of diffusing new techniques in widely spreading smaller companies, subcontract production systems developed by leading large firms play a very important role. In most cases, master companies give intensive technical guidance in improvement of production equipment, quality control, and training of technicians which results in satisfactory quality and cost of products required by them. On the other hand, it is important that smaller companies, as receivers of such guidance, have rich experience in production, skilled workers and drive for competition in digesting new technology. These qualifications of small businesses have been developed over a time under domestic conditions. Native industries traditionally existing in local areas have been a major source of supply of small firms thus making important contributions to the present industrial structure. Foundry, ceramic and textile industries for example, have frequently developed special production areas.

Reliability of parts and semifinished products produced by small scale industries is an essential prerequisite for Japanese subcontracting practices. The American automobile industry shows a lower rate of dependency on subcontract manufacture than in Japan, and it sometimes suffers labor disputes, making it difficult to maintain stable supply. In West Germany, machinery, precision, and chemical industries have been prevalent historically and technology has been highly advanced with specialized industries distributed locally. Recently, however, the country is slipping behind in adapting electronic technology and is having difficulty, because it has been suffering underdevelopment of specialized electronic parts industries before worldwide trends toward electronic conversion in the machinery industry or elsewhere. It is one of the favorable conditions in following technological changes in an international environment that Japanese smaller businesses are competitive at high technological levels and are sufficiently mature to assimilate new technology.

1-2. Role Played by Introduction of Foreign Technology

It is widely known that Japanese industry has introduced technologies, from the world over and completed advanced technology by improving these technologies. From an international point of view, it is important to know that technologies are mostly traded simply by themselves with somewhat limited capital and management participation such as direct investment. This is partly because restrictions were imposed by Government on the introduction of foreign capital till the middle of the 1960's but mainly because Japanese industry had sufficient technological experience to absorb new technology and years' of accumulation of productive activities in each technological sector. For the introduction of technology in those days,

Table 1. Industrially Classified Expenses for Research and Development in Major Countries (1971)

Authority: OECD "Patterns of Resources Devoted to Research and Experimental Development", 1975, Paris

	Japan % (governmental)	U.S. % (ditto)	Britain % (ditto)	France % (ditto)	West Germany % (ditto)	Italy % (ditto)
Total	100 (35)	100 (61)	100 (56)	100 (60)	100 (47)	100 (42)
1. Financing authorities						
Government	14 (14)	15 (15)	24 (24)	28 (28)	10 (10)	22 (22)
University	19 (19)	14 (14)	8 (8)	15 (15)	19 (19)	17 (17)
Nonprofit corporation	1 (1)	4 (4)	3 (3)	1 (1)	10 (10)	–
Industry	66 (1)	67 (28)	65 (21)	56 (16)	61 (8)	61 (3)
2. Industrial classification						
Aeronautic	–	18.1 (14.4)	15.7 (14.1)	11.3 (8.7)	7.0 (4.5)	–
Chemical	15.3 (0.1)	8.5 (0.7)	9.5 (0.2)	9.8 (0.2)	16.4 (0.1)	14.1 (0.2)
Electronic and electrical	17.0 (0.2)	16.5 (8.4)	14.6 (5.0)	14.8 (5.3)	16.2 (1.8)	10.6 (1.2)
Transportation equipment	8.4	6.4	5.0	5.9	9.5	15.4
Metal	5.1	1.9	2.8	1.9	2.1	1.2
Machinery	7.1 (1.0)	9.2 (2.9)	6.0 (1.6)	5.1 (1.7)	8.0 (1.2)	5.0 (0.7)
Foods and commodities	4.1	1.9	4.0	2.4	0.8	5.0
Other manufacturing	3.2	1.9	2.1	1.4	1.1	0.8
Non-manufacturing (agricultural, mining and service)	6.3 (–)	2.6 (1.7)	4.0 (0.1)	3.3 (0.1)	2.5 (0.7)	8.5 (0.7)

the technological and managerial abilities of industries as the recipients of the technology were required to be sufficient to digest the technology introduced. Thus, it was the duty of major traditional companies which had experience in production using existent technology at home to absorb and digest new technology. In introducing technology for the petrochemical industry, for example, it was mostly the subsidiaries of the traditional Japanese zaibatsu chemical groups, such as Mitsui, Mitsubishi and Sumitomo which were the predominant industries for coal chemistry in those days and major oil refining companies that were selected as the center of a new petrochemical complex. Also, technology for semiconductors and IC (integrated circuits) elements which have undergone intensive technological renovation was introduced primarily by the general electric machinery companies such as Hitachi and Toshiba. Consequently, while in the U.S., which developed technology by itself, smaller companies specialized in electronic parts appeared in swarms, out of which large specialized companies in semiconductor industry have been growing. In Japan, it was the versatile large companies which had their own markets for various final products that developed technology for producing most advanced electronic parts and integrated circuits. At present, it is recognized that Japanese electronic parts, except special items, often exceed American items in cost performance and especially in reliability. One of the acknowledged reasons for this is that the scale of research and development, the effects of massproduction and capability of quality control of large versatile companies are very advantageous, in producing sophisticated microproducts.

1-3. Research and Development for Improvement

Japan, starting with the introduction of technology in the postwar period, successfully made continuous progress just because the country favorably made best use of the new technology and new products introduced. Adaptive efforts for foreign technology gradualy enriched the ground for improvement. In this process, systems for the development of improved technology and new products were established. At present, Japan is recognized as the fastest country in the world to absorb new technology. Furthermore, in such electronics applications as video recorders and robots the reputation that Japan is advanced in developing new products and technology for commercialization has come to stay.

Currently, Japanese industry has been making a shift from improving research with limited cost of research and development, to applied research with gradually increasing costs, and at present carrying out research and development with a considerably high cost, as is observed in the development of new products such as integrated circuits and video recorders.

Increase in the originality of Japanese technology may partly be seen by the growth of technology exports to the world. In 1971 the value of receipts from technology exports of all industry was Yen 27,187 million, which amounts to only 20% of payments for technology imports. However in 1979 receipts were Yen 133,145 million, which amounts to 55% of the payments. During the period from 1971 to 1979 exports thus increased almost 5 times while imports increased less than 2 times.

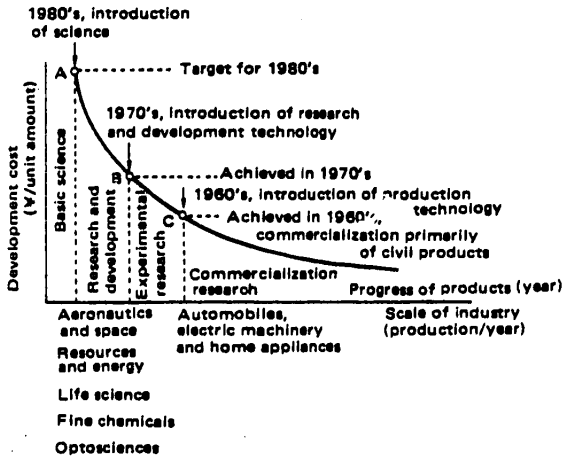

Fig. 1. Characteristics of Industry and Cost for Research and Development

The greatest surplus of technology trade in 1979 came from iron and steel, and construction industries while the greatest deficit came from the electrical and electronics, and transportation industries. It is interesting to note that there are certain time lags between the performance of a particular commodity trade and that of technology trade for each industrial sector.

2. Technological Development for 1980's

2-1. Importance Given to Basic Science

As described earlier, the structure of Japanese technology can be characterized as being very market oriented and highly efficient. These characteristics are illustrated in Fig. 1, where intake of new technology occurs at different stages of product development over a time. In contrast to the flow of typical technological development which starts with a principle and, via basic and applied research, achieves commercialization,

Japanese technical development has been predominatly via the back door, "backward engineering", which first introduces technology directly necessary for production and after digesting it, introduces more advanced technology. In the 1980's, however, it is likely that development of already available or existing technology in Japan will be completed but instead, basic science as a seed for technology will be increasingly more necessary. It is hardly possible to cover all achievements of basic science by introduction from foreign countries, like conventional technological introduction but the country will be required to make achievements mostly by itself.

Here, "forward engineering" type research and development systems, which, while building up basic science, connect inventions and discoveries as its fruits to research and development, and further, to industrialization are found important. Studies, for example, on the properties of materials under extreme conditions, such as ultra-high pressures and ultra-low temperatures have lead to the development of super-conductivity and new materials. Also, applied fields of life science, such as genic rearrangement, cover unfathomable scope. Electronic semiconductor devices such as sensors and optical elements must be made practical and useful as new functional materials. This requires an increase in public finance for research, building up of researchers and improvement of research environment to permit research activities in the fields of basic science. It is also important to invite substantial demands for maintaining close relations established with production shops so that the results of research will be appreciated and utilized. While the roles of universities and government research institutes will increase in view of the creativity of research, the organization of government-financed basic scientific research projects advantageous in making use of industrial experience in production will be promoted as practical systems for organized basic research and development.

2-2. Advancement of Technological Structure

It is pointed out that one of the characteristics of the Japanese technological structure is the lack of technologies in special fields. In the 1980's, it will be necessary to develop these "missing links". Typical examples of such development are technology for developing natural resources and energy, and space and aeronautic technology.

For technology for developing oil, coal, and mineral resources, the predominant companies are the multinational majors and it is impractical for Japan to promote its own research and development because development sites are located overseas. However, technology indirectly related to resource development, such as technology for refining crude materials or technology for transporting energy and raw materials is at high levels in Japan. Thus, developments will be eagerly promoted in new technological fields, such as

development of processing low-grade ores, collection of waste oil and cracking of heavy oil, which have somewhat missed international attention.

More positively, Japan's efforts at research and development must be directed in such a manner as to be free of dependency on existing resources and energy such as oil and coal, thus, importance should be given to development of renewable resources, recycling of resources, research on new energy sources including nuclear fusion and atomic power generation, and development of technology for saving energy. Some examples of Japanese technology recently being appreciated in these fields include technology for high reliability of atomic reactors for power generation, technology for solar energy systems for heating and cooling,and for collecting waste heat, and technology for neutrilizing resources in urban garbage.

Technology promising in chemical fields may include technology for saving energy and resources by applying biochemical reactions, developing new materials, developing techniques for energy conversion including fuel cells, and for improving thermochemical processes and thermal energy.

Technological development about resources and energy generally uses large-scale systems, requires long years and involves high risk. In such cases Governmental research is called for. For example, Agency of Industrial Science and Technology has been promoting its "Sunshine" project for developing new energy sources, and the "Moonlight" project for developing technology for saving energy. In October 1980, a semigovernmental organization called New Energy Development Organization was started, as a development system to permit consistent research and development from basic to applied research, and from prototype and demonstration plant development to practical use.

In major foreign countries, space and aeronautic technology is a special field closely related with the growth of the military industry. In Japan, technological development in these fields is being promoted in the absence of any military industry. However, it is important to improve technological levels in these fields successfully, hence it is a pressing necessity to carry out national projects such as the development of domestic aircraft such as YXX as a subsequent to YS11 the first Japanese turboprop aircraft, communications satellites, resources search satellites and jet engines, which can have a large technological influence but require enormous amounts for research costs and advanced systems for research and development.

The presence of research and development intensified industries and companies is essential to the advancement of a technological structure. In this respect, it is desirable that the weight of what is called "hi-value added" processing industries, such as pharmaceuticals, precision machinery and electronics, will increase. Because in these industries, it takes much money and time, as it takes long to train personnel,

to accumulate technology, they will be highly appreciated internationally. They will successfully acquire adequate capital for research and development by achieving high added value and entrain a favorable circle toward advance when they exceed certain technological levels. However, they will encounter fierce competition on the way. This is why years of accumulation of efforts are necessary before highly creative technology with significant bargaining power is developed.

2-3. Development of Social Technology

In the most important fields to be dealt with by technology, are a wide variety of problems concerning society as a gathering of individuals. The urban problem is a typical one, and they are mostly important problems directly related to daily life, such as education, medical treatment, culture and environment. Technological development in these fields is rather dissimilar to technological development for commercial individual products in which Japan is adept. For example the application in social situations is more important factor rather than production in plants, and consumption by groups is more usual rather than individual purchase. Thus, society participates to a greater extent in the determination of the aims of research and development, and the decision making by those demanding depend on the general technological knowledge and the ability of society to bear the risks. For these reasons, it will be an important problem to train "social enterprisers" who stimulate and create favorable environments for technological development.

As local systems, for example, attempts primarily by local governments to promote the development of wind power, solar heat, geothermal energy and small hydraulic power in local areas, and introduction of local information systems will become important in elevating the technological ability of society. Also, medical equipment, and educational and training systems will be important.

Technological development concerned with society is hard to deal with on a short term basis in the market mechanism and will hardly be successful by individual production technologies. It will succeed only in integration with society and thus it is hoped that central and local governments will play an important role in planning and encouragement.

3. Technological Development and International Cooperation

3-1. Internationational Cooperation through Innovation

Since the oil crisis in 1973, countries throughout the world, suffering from stagnant economic growth and increasing unemployment, inevitably have pressed to sacrifice international trade in order to defend their domestic economies. Fortunately, Japan has recovered her economy fairly soon by increasing

trade with middle and near east markets, and building up its international competitiveness in respect of automobiles and home appliances. It was because the country could make a swift response to a changing world economy. Present world economy is not the same as in the past when the entire world economy was in a growing phase, and the economy of each country was more or less able to grow. Once the world's economy becomes stagnant, however, countries will be affected widely and differently depending on their economic competing power, as was observed in the oil crisis. This is why countries have been giving serious consideration as to how to maintain the growth of the world's economy.

Such problems as how to attract oil money to the world's economy and how to keep orderly exportation have been discussed at international meetings and in the course of such discussions, the stagnancy worldwide of technological renovation was one of the problems taken up. In Europe and America, there are many pessimistic arguments on it and, world innovation and growth, that there is no longer any sufficiently large technology to start a new industry. In the past decades, the U.S. developed most pioneer technological industries, such as petrochemicals, electronics, and space and aeronautics. But recently, Japan and European countries are catching up, and it is apparent that the U.S. is somewhat uneasy about having difficulty in promoting technological development as the nucleus of an advanced industry to which the country wishes to return. As is shown in Fig.1, Japan is reaching the phase, in the 1980's, in which the input of science is required. The U.S., on the other hand, was making much greater efforts to develop new technology throughout the 1960's and 1970's.

Under these circumstances around the world, it is understandable that Japan is obliged to make significant efforts in the 1980's to develop technology worldwide and supply it to the world economy. It is true that the scale of research and development reaches to an enormous extent, and innovation becomes much more costly and difficult. In the fields of nuclear fusion, it is becoming economically impractical for individual countries to construct the most advanced accelerators without asking for worldwide participation. In technology for coal liquefaction, joint research by the U.S., West Germany and Japan is being carried out to construct experimentally a demonstration plant with a capacity of 6,000t/day. In this way, international specialization in gigantic technology is becoming realistic. In order to provide a basis for such international cooperation, there is an increasing need for Japan to develop its own and unique technology and it will be increasingly important to train personnel to perform leadership in the world.

3-2. World Factory to World Laboratory

Another mission of Japan is to find the way of promoting technology transfer primarily by industries to developing countries. Production know-how developed by Japanese industries while they introduced and assimilated a lot of foreign technologies is unmeasurable. Labor intensified technology, in particular, which was developed primarily by labor power in the postwar restoration periods, has been fully taken in by Japanese quality control and plant management.

For the quick transfer of technology from advanced countries to developing countries, only that of highly capital-intensified plant-based technology will be successful. However, a look into the way technology is adopted in developing countries on a long-term basis will make clear that the elevation of technological abilities of workers is prerequisite to success.

During the 1970's Japanese industry has established various overseas production bases primarily in Southeast Asia. So far the influence of such production is rather isolated from local technological systems, in the future, it should contribute to the development of these foreign countries by elevating their technological levels. Production activities will not be welcomed by society unless they are admitted by the social values of technology. Transferring technology in such a manner as acceptable to society will consolidate the foundations for mutual respect and reliability between donner and recipient country. It will be the important role of Japan to make plans for technological transfer in the world, carry out studies on the improvement of existing manufacturing processes and try to improve the ability of workers at production sites to perform research and development, while taking into account the characteristics of foreign countries. It will be an important task in the 1980's to shift the emphasis from the trade of products to that of technology. Therefore international co-operation by carrying out technological assistance, and research and development becomes most important. If it will be successful to build up international technological network for world development, that should be exactly the way a peace-oriented nation should proceed.

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SCIENCE AND TECHNOLOGY

MATERIALS: 'PROGRESS TOWARD TECHNOLOGICALLY-ORIENTATED NATION'

Tokyo TECHNOCRAT in English Vol 14 No 8, Aug 81 pp 32-37

[Text] The Industrial Structure Council of the Ministry of International Trade and Industry (MITI) submitted "A Report on Policies for Trade and Industry in the 1980's" in March, 1980. Chapter 6 of the report outlines orientation of Japan's technological policies in the 1980's under the title of "Progress Toward a Technologically-Orientated Nation".

As a reference for understanding Japan's orientation of technological policies in the 1980's, chapter 6 of this report is outlined below:

"Progress toward a Technologically-Orientated Nation"

Section 1. Progress of Man and Society and Technological Innovation

< Technological Innovation Starting New Age >

Within recorded history, technological innovation has always been the key to the future, promoting social and economical development. Technological innovation in European agriculture in the 12th and 13th centuries brought about rapid increases in population, development of cities, and economic advance. Use of the magnetic compass in Europe in the 14th century opened the age of long-range voyages in the 15th century, and the invention of steam engines and similar discoveries in the 18th century triggered the Industrial Revolution.

In this century, technological innovation has advanced over wide fields to form today's affluent materialistic civilization. Innovations have emerged successively to include chemical fertilizers started by the fixation of free nitrogen in air, high-molecular chemistry started by nylon, automobiles,

aircraft, transistors, IC's and computers, and more recently, the use of atomic energy and outer space. Indeed, civilization today is supported by technological innovations so far accumulated.

< Current Feelings about Technology >

Looking toward the future, in the 1980's, we find ourselves faced with the tasks of maintaining social energies and improving the quality of people's lives under restrictions in respect of energy. As keys to their solution, people have great hope for technological innovations.

Science is knowledge mankind has acquired as an asset by discovering various laws of nature. Technology creates benefits by applying accumulated scientific knowledge to social activities.

Today, there are not many instances of epochal technological innovation without which, some fear that the problems we have today cannot be fully solved. In the 1980's, however, it is possible to develop new aspects in economy and society by applying or assembling existing technologies, and there is much hope that new technologies will prosper by newly applied scientific knowledge. And the 1980's is a time when we should prepare for epochal technological innovations which are expected to blossom in the coming generation in and after the 1990's.

People usually associate technology with "advances in society", "affluent life", "hopes toward the future" and "convenience". On the other hand, however, as technology advances, becoming complicated and gigantic in size, some come to feel indifferent to, and apprehensive about technology. Again, there are increasingly strict demands of technology, primarily because of safety. Without any measures for such, people will be disappointed by technological innovations, possibly halting technological innovations and depressing society. Thus, it is necessary to take appropriate measures with strenuous efforts by offering adequate information about technology, assessing possible effects of technology and promoting research and development for improvements in respect of safety.

Modern technology is characterized by large-scale centralized techniques. Recently, there has been the idea of community technology which is of a distributed type on an adequate scale and which contributes to improving local economy and social situations, and it should receive attention.

In the 1980's, international exchanges in the field of technology will be further promoted. Joint research projects among advanced countries and transfer of technology to the developing countries are important means of solving problems common to mankind.

Section 2. Progress Philosophy of a Technologically-Orientated Nation

< Situation of Technology in Japan >

Today when there is much anticipation for technological innovations, Japan, as an economic power, will actively serve the world, playing the role of an innovator, while cultivating its own creative ability.

On the other hand, Japan stands in the situation of being caught up by new industrialized countries and in the midst of fierce competition between advanced countries. Particulary the competition among the advanced in the development of high technology is expected to intensify. Thus, for Japan, it is very important to make the best use of brain resources, which may be called the country's sole resource, and develop creative and independent technology.

If Japan acquires independent technology, it will maintain and promote the advantage of Japan's industry and form the foundation for long-term economic and social development. For Japan which is weaker in respect of energy and resources than other advanced countries, having independent technology will augment its bargaining power and contribute to acquiring economic security. Developing the country on the basis of technology is the way Japan should take in the 1980's.

< Japan's Technological Level >

Since the end of the war, Japan has been actively introducing technology from advanced industrial countries in America and Europe, trying to improve on it and making efforts to promote independent development. This has elevated the level of technology in Japan's industry to the world's highest in almost all fields except for some high technological fields. Japanese goods are internationally well appreciated because of advanced techniques for production and sales, such as high quality, reliability, complete servicing and prompt delivery. Japan will maintain these features and further elevate technological levels.

On the other hand, in order to deal with various problems in the 1980's, it is necessary not only to refine existing technology and raise the competitive power of goods but also to promote unique and creative technological development. Some doubt exists about the ability to achieve this. However, it is presumed that the potential of technological development is sufficiently enough, by taking into account that Japan ranks highest in the number of patents registered for foreigners in the U.S., new agreements in technological trade showing an export surplus after 1972, the growing number of graduates from science and technology educational departments, and current high technological levels.

In the future, Japan should make these features sufficiently effective to achieve good results.

Section 3. Problems in Technological Development of 1980's

< Social Demands of Technology >

Social demands of technology are the promotion of technological innovations. In promoting technological development, it is necessary to correctly recognize social needs. Social demands of technology in the 1980's could be four, as follows:

1) To overcome restrictions on energy.
2) To improve life qualitatively and enrich communities.
3) To promote intensification of creative knowledge in industry.
4) To attempt technological innovations for coming generations.

< Key to Solving Energy Problems >

Basically, technological developments are required to solve energy-related problems. First, technological development of substitute energy sources for oil, and secondly, that for saving energy must be promoted rapidly. Again, technology for developing oil must be further improved.

The technological development of substitute energy sources for oil can be the following:

(1) Technology for utilizing atomic power

It is necessary to develop new types of reactors designed to make more effective use of nuclear fuel, establish nuclear fuel cycles and develop technology for using atomic energy for various purposes.

(2) Technology for utilizing coal

It is necessary to develop technology for liquefying and gasifying coal, and technology for burning mixtures of coal and oil.

(3) Technology for utilizing solar energy, etc.

Various technological developments must be promoted including the following:

a) Technology for solar generation and solar space and water heating.
b) Technology for utilizing terrestrial heat and water.
c) Technology for developing and utilizing new sources of fuel oil such as oil sands and oil shale.
d) Technology for utilizing small-scale hydraulic power.
e) Technology for utilizing biomass.

(4) Basic research for nuclear fusion for the 21st century

Technological development for energy saving may cover the following fields:

(1) Industrial sector

It is necessary to develop MHD (magneto-hydro-dynamic) generation, high-efficiency gas turbines, new storage cells and

electricity storage systems, fuel cells, and waste heat collection systems.

(2) Household sector

Energy-saving home appliances and housing systems must be developed.

(3) Transportation sector

Engines must be made more efficient to reduce fuel consumption.

On the other hand, for technology for oil, the following will be essential:

a) Surveying technology for under severe environmental conditions such as deep seas and iced polar areas.

b) Technology for secondary and third collection.

c) Technology for increasing safety in oil conglomerates and reserving oil.

d) Technology for treating heavy gas oil.

In general, energy technology involves investigation of large-scale systems, taking long years and large sums of capital and risk for development. Thus, a system relying on non-governmental efforts is insufficient for the development of energy technology. Industry, academic circles and the government must cooperate under strong leadership of the government in such development from basic to applied research, and in making achievements practical. Governmental roles in capital and the coordination of research, primarily through comprehensive new energy development organization which started in October, 1980, must be drastically extended. Again, it is necessary to complete systems for putting achievements to practical use.

In addition, where achievements may possibly disperse before commercialization, after success in technological development, it is necessary to make it a point to retain supply facilities and keep them in operation even at some cost. This can be considered to be the reserving of technology.

< Qualitative Improvement of Life and Enrichment of Communities >

There are many problems in technological development to meet a variety of needs by the public who desire qualitative improvements.

First, it is required to develop products having new and complex functions and high performance, and designs with increased safety and endurance. Furthermore, considerate care and qualitative improvements are desired in distribution and the supply of other services.

Secondly, it is likely that there will be increasing social needs in respect of housing, cities, transportation, medicine, welfare and education. To meet these needs, it is necessary to develop and promote the following:

(1) Layer modules to make effective use of land and develop quality dwellings by making effective use of natural energy.

(2) New transportation systems such as linear motor cars, traffic control systems and piggy-back systems.

(3) Social systems for daily life including medical data systems and life video data systems.

(4) Medical apparatus such, as artificial organs and instru-

ments for examination, and welfare apparatus such as those for handicapped persons.

Thirdly, strenuous efforts are also required to develop technology for environmental preservation, safety and hazard prevention for improving life environment. Thus, the following must be developed:

(1) Technology for utilizing reclaimed sewage and drainage to meet pressing demands for water.

(2) Technology for safety and hazard prevention including prediction of earthquakes and wide-range protection against calamities.

(3) Technology for preserving the environment newly required in consequence of changing energy source types including technology for treating smoke and ash produced by direct combustion of coal, technology for treating heavy gas oil, and technology for treating drainage produced by processing biomass.

Fourthly, in order to improve the growth of local economies and as well as balanced nationwide use of land, it is important to develop community technology for local energy systems and resources recycling systems in addition to conventional large-scale centralized technology. This can be the nucleus of local industry, promoting efficient use of resources and meeting needs of residents for employment and the living environment in local areas. Here, local governments are expected to play the role of developers of technology, not simply the users, by improving public experiment and research agencies, and helping establish links between national experiment and research agencies, universities and local industry.

< Technological Development for Intensifying Creative Knowledge in Industry >

The intensification of knowledge in industry is supported by technological development. In order to exercise creativity, raising the level of existing industries and to exploit new industrial fields, continued efforts should be made to develop technology.

In the 1980's, main courses will be the following two:

(1) Technology for Forming Systems and Incorporating Software

Although industrial technology in Japan has matured to a high level in many fields, there are trends towards increasing importance of technology for forming systems provided with new functions by combining component units and processes and technology for incorporating software, including techniques for application, design and services, in hardware.

For technology for forming systems, it is required, where production activities have become huge as we see them today, to recognize the whole as a large system and give consideration to its efficiency in addition to the efficiencies of individual processes. The emergence of new systems produced by links between different industries is very likely to induce striking increases in efficiency, new products and new services.

Technology for incorporating software is represented by making machines and processes intelligent by incorporating microcomputers in them. The emergence of VLSI elements

makes it easier to use microcomputers by reducing costs and the size of equipment. The application of microcomputers in production processes, together with advances in sensor technology, will make industrial robots intelligent, enabling unmanned plants to be realized. This will make possible (1) multiline small-lot production, (2) energy and resources saving, (3) uniformity of quality, (4) improvement of the labor environment. Again, application of equipment will enable functions to become versatile and advanced.

Software and systems technology will conceivably develop not independently but interdependently or with making up for each other's disadvantages.

(2) Technology Based on New Scientific Knowledge

It is necessary to develop the following:

a) New materials, such as amorphous materials, optical fibers, new ceramics, highly functional resins, composite materials and ultimate materials.

b) Laser-applied technology.

c) VLSI elements and sensors.

d) Advanced software, including pattern recognition and artificial intelligence.

These will bring new industrial fields into existence in the 1980's, while representing common basic techniques for raising the quality and performance of products and the quality of production processes.

< Attempt at New Technological Innovations for Coming Generations >

It takes much lead time for new scientific knowledge to be fully adopted in industry and society. This requires repeated efforts to search, cultivate and industrialize all technological seeds. The 1980's, in particular, will be an important period for preparations for innovative technological improvements which are expected to emerge in and after the 1990's.

Seeds of technological innovations currently presumed for the coming generations include the following:

(1) Life Science

It will give limitless dreams to the development of economy and society to apply life phenomena in medical, chemical, and dietary analyses while explaining and giving appropriate and careful consisderation to them.

a) The discovery of chemical reactions in live systems and the advanced use of enzymes will permit the synthesis of highly functional materials and chemical processes at normal room temperature and pressure.

b) The establishment of technology for manipulating genes will bring about epochal development in medical, dietary and chemical fields by curing genic diseases, increasing the production of food by plant breeding, using biomass and microorganisms in fine chemistry.

c) For interferon, considered hopeful as a specific drug for cancer, commercial production is expected in the mid

1980's. Again, if the generation mechanism of cancer is explained at the molecular-biological level, great progress in cancer therapy will result.

d) The application of photosynthetic functions after explaining them will enable the production of foodstuffs to be increased.

e) The use of sensory organs of biological entities will develop advanced sensors.

(2) Energy

There is much expectation for nuclear fusion as the inexhaustible energy supply of the 21st century, along with solar energy, which is coming into practical use. Nuclear fusion which produces about 100,000kWh of energy from denterium which is contained in seawater at a ratio of about one g per 25*l* of seawater will be Japan's most hopeful resort for the supply of energy.

(3) Information Processing

Josephson elements which make use of the phenomena of electrons under cryogenic conditions exceed current LSI elements by a factor of some decades in operational speed and by a factor of a 1000 in power consumption economy. A Josephson element, a little more than 10cm square, is expected to provide the same functions as those of a current large computer. Again, artificial intelligence can be further developed by developing information processing systems in which memories and sensory systems in live entities are applied.

(4) Space and Marine Development

It is expected that efforts will be made at technological innovations in various fields including the supply and transmission of energy, making use of outer space, space plants, the development of resources such as manganese nodules in deep sea bottoms, and the production of food by making use of the seas.

Section 4. Fields of Technological Development under Governmental Leadership

< Three Fields of Technological Development under Governmental Leadership >

As seen above, there are many items of technological development to be achieved in the 1980's. Not a few of them are expected to be developed by nongovernmental efforts. However, technological developments in fields such as:

(1) those in which developments are likely to have extensive effects on the economy, society, industry, and technology from a long-term point of view, will take a long time to reach actual use,

(2) those in which development requires cooperative systems between companies because of the necessity of combining component techniques from various fields and that also require investment of large sums,
(3) those in which economically, society is in great need of development, requiring appropriate measures to be taken promptly, and desiring development to be accelerated, and
(4) those in which development is based on public needs and require to be coordinated with social systems,
cannot be entrusted to private enterprises alone for smooth achievement and require the government to concentrate its efforts to promote research and development and organize projects.

These fields of technological development, in practice, include the following:
(1) Technology for new materials represented by electronic elements.
(2) Technology for large-scale systems represented by technology for alternative energy sources.
(3) Technology for social systems represented by life-related social systems.

< Technology for New Materials as Basis for Various Industries and Techniques >

Technology for new materials can be the basis for new products and new production processes, and can be applied very extensively in industry.

Today, it is required to develop new materials, such as optical fibers, new ceramics, amorphous materials, highly functional resins, ultimate materials, and composite materials. These materials can be bases for various industries such as chemistry, medical equipment, electric and electronic devices, machines and aircraft, sufficiently effective to bring about new products. Also, in technological development for substitute energy sources and saving energy, the development of materials will be the important key.

Production processes and equipment can be made intelligent by incorporating in them, VLSI elements, sensors, miniature batteries, permitting multiline small-lot production and improvements in efficiency and functions.

Most of these technologies for new materials cannot generally succeed simply by improving existing technologies but require continuous basic research over long years. In research and development in these fields, Japan has not yet achieved ample results. Such developments involve much in the way of risk. Thus, the government should take measures to stimulate the public to development. Again, the government, universities and private enterprises should improve systems for basic research from the long-term point of view.

< Technology for Large-Scale Systems Involving Big Risk >

Hopeful developments may include the liquefaction and gasification of coal, the establishment of nuclear fuel cycles, new types of reactors, solar generation, deep layer terrestrial generation, and nuclear fusion in the fields of energy and those of technology for large-scale systems, such as ultra-high-speed computers, space developments, marine developments (development of mineral resources on deep sea bottoms in particular) and aircraft, in the fields of new pioneer industries.

These developments require systematizing engineers and technological information over a wide range, from materials to machines, electronics, information processing and system developments. Also, they are difficult for private enterprises alone to carry out because of many years' of preparation and big risks in terms of capital. Thus, it is necessary for the government to actively invest capital, complete systems for development, bear risks to some extent and exercise coordinating functions.

In addition, it is essential to develop software, including advanced designing, control and information processing for combining component techniques over wide areas.

< Technology for Social Systems to Acquire Harmony with Society >

Technology for social systems here means not to deal with systems for producing goods but to supply quality social services by developing individual units and utilizing techniques for information processing and communication. Here, technology often involves cases which require not only simple technological means but also changes in social systems and customs.

For instance, in developing medical information systems, it is necessary to shift from examination and treatment systems in individual hospitals, to systems for prevention, examination and treatment in communities. Also, in propagating traffic control systems, it will be necessary to revise traffic regulations and change various rules. For social systems relating to development of urban areas, it is essential to position them appropriately in local developments. Many of these systems assume the character of being public assets for which it is difficult to seek profits and determine prices.

For these reasons, technology for social systems is in the fields for which development incentives of private enterprises can hardly be provided, and the government or the third sector should take the lead in development and propagation. Here, it is essential to provide collaboration and close affiliation between government ministries in particular and further between local governments, and this will enable technology to be established smoothly.

Technology for social systems is closely concerned with society, life and humanity. In order to elevate its social acceptance, it will be important to make additional use of knowledge in the social sciences and humanities.

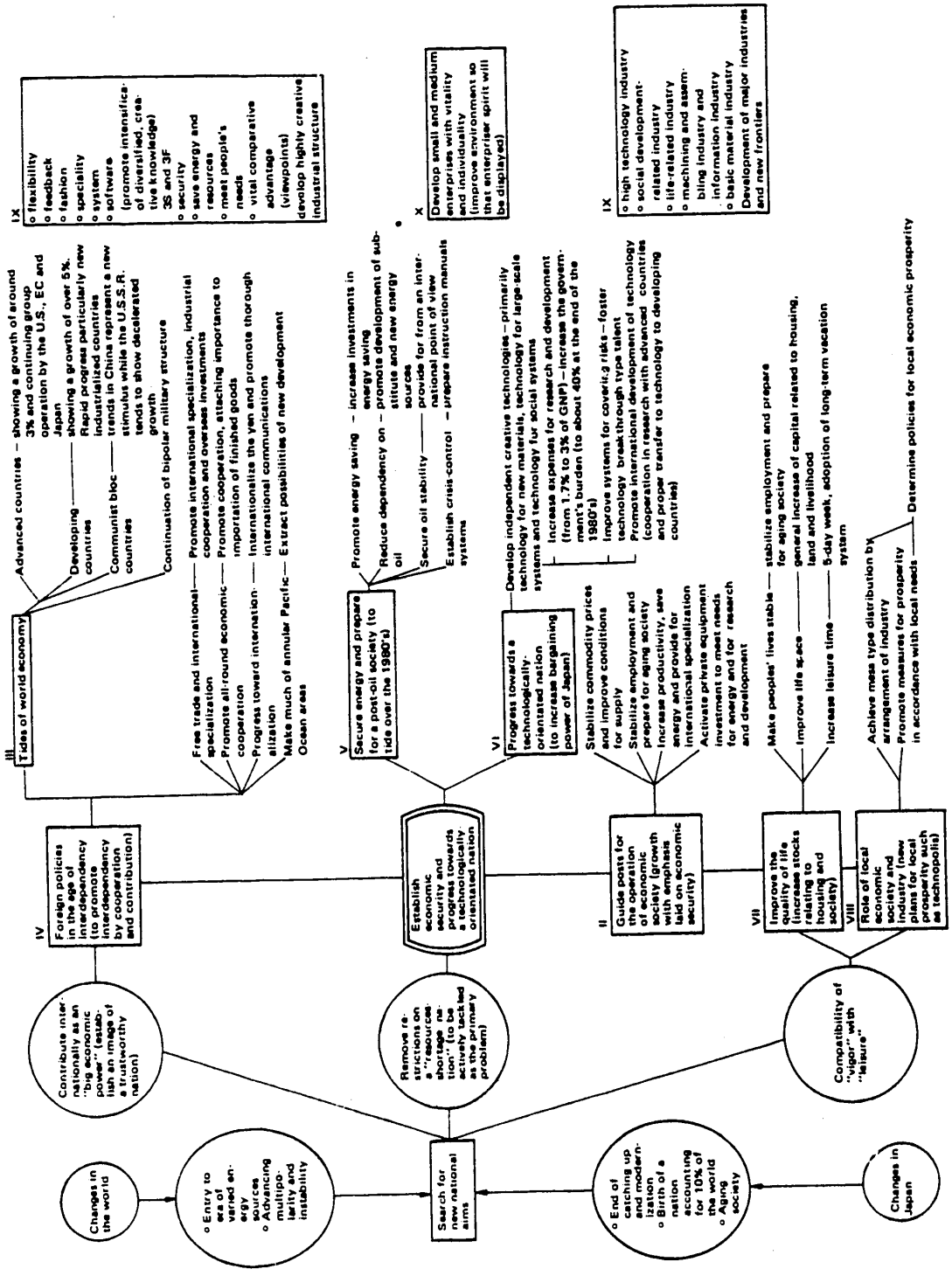

Fig. 1. Chart of Policies for Trade and Industry for 1980's

CSO: 4120/105

SCIENCE AND TECHNOLOGY

HIGHLY SENSITIVE PHOTOSENSITIVE RESIN DEVELOPMENT APPLAUDED

Tokyo TECHNOCRAT in English Vol 14 No 8, Aug 81 pp 40-41

[Text]

Those industries making extensive use of IC's, LSI's and other electronic technology are thriving at present. This has been made possible by development of high-resolution and highly sensitive photosensitive materials that make it possible for LSI's incorporating tens of thousands of elements to be quickly printed on a substrate only 5mm square. But realization of photosensitive materials with higher resolution and sensitivity is in demand, since development of a super LSI integrating a million elements on a substrate of the same size is the immediate target.

To meet this demand, the Research Institute for Polymers and Textiles of the Industrial Science and Technology Agency has started a project to develop a "highly sensitive polymer material of the screen image type (photosensitive resin)" and, at the same time, has started similar study using an argon laser, etc. and study to develop a suitable photosensitive material for holograms, also using an argon laser.

The object is to develop by 1985 a highly sensitive photosensitive photo-resist material for printing, with a sensitivity 10 times greater than previous levels, and a photosensitive material for copying and photography that is more than five times as sensitive as those presently available.

When realization of these photosensitive materials is made possible by these studies, the printing of hundreds of thousands of elements on a single substrate through the appearance of a photosensitive material sensitive to a laser of 1 mJ/cm^2 (ASA approx. 1/100) will no longer be a dream, and remarkably enough, great advances of not only electronic technology but also information processing will become possible.

This article summarizes recent achievements in development of highly sensitive photosensitive resins.

1. What Are Photosensitive Materials?

Photosensitive materials are materials that react chemically when they receive light. In this category, there are, for example, silver halides for photographic film and cinnamic acid for photosensitive resin.

Industrially, the photo resist for LSI manufacture hyperfine processing, and the photo resist, used for such purposes as

for printing and platemaking represent present efforts to produce LSI patterns for semiconductors by applying the photosensitive resin to semiconductor material, exposing the LSI circuit pattern to light, then dissolving the portion not exposed to light by a chemical solution, and finally removing the resin from the surface of the semiconductor. These resins are now indispensable to LSI manufacture because they are inexpensive and easy to handle.

2. To Increase Resolution

However, if the resolution of a photosensitive resin is to be increased in an attempt to project a fine LSI pattern, the resin's sensitivity to light inversely becomes less.

A photosensitive resin with a resolution of 1μm to 0.5μm, sufficient to cause light diffraction, has already been manufactured tentatively and at present this degree of resolution seems to be the limit. Some resins used in mass production have a resolving power of 2~2.5μm. A super LSI with 64K bits can be developed using a photosensitive resin at this level.

Under these circumstances, it is the sensitivity that is the problem. Different research organizations are now studying to develop materials that will enable an image the size of a newspaper page to be projected in two minutes by merely applying energy of 1 mJ/cm^2 to a photosensitive resin. Also, attempts are being made to increase the photosensitive base of resins by adding suitable sensitizers because of poor sensitivity to light.

The development of highly sensitive photosensitive materials is, indeed, important enabling resins meeting these requirements to be produced.

3. New Photosensitive Materials and Their Capacities

Present research and development are concerned with the following:

(1) Development of a photosensitive material that has a photosensitive capacity 10 times greater than previous levels without using a sensitizer

This is an effort to develop a highly sensitive resin free from reduction of sensitivity and resolution below their theoretical values, which is the case of conventional photosensitive resins, which often show abnormal reactions to light (including the combination of photosensitive bases).

The method employed consists of taking advantage of paraisopropyl cinnamic acid which releases electrons when the photosensitive material receives light, and paracyano cinnamic acid which absorbs electrons when the photosensitive material receives light.

In a photosensitive resin produced by combining these photosensitive materials separately with polyvinyl and mixing them together, paraisopropyl cinnamic acid releasing electrons and paracyano cinnamic acid absorbing electrons combine as soon as the resin receives light.

Since these acids naturally attract each other as positive and regative, the resin shows satisfactory sensitizing effects and selectivity, and in the past studies, the sensitivity has reportedly been increased nearly five times.

The sensitivity further increases through the addition of a sensitizer. The Research Institute is trying to develop photosensitive material with a sensitivity 10 times greater than previous level and also by changing the combination of photosensitive base materials.

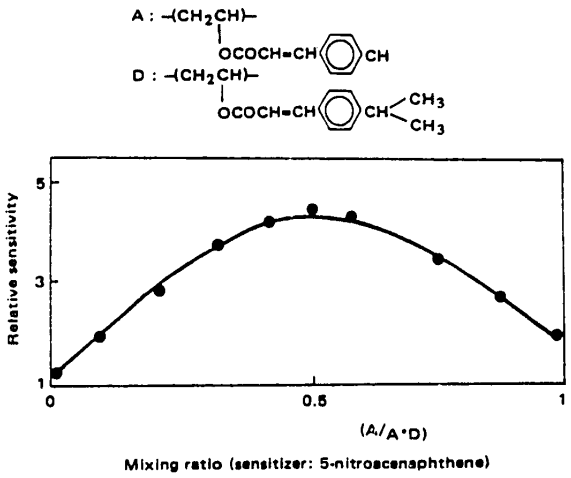

Fig. 1. Effect of Mixing on Relative Sensitivity

(2) Development of photosensitive material using the polymer effect

This effort is aimed to develop photosensitive material that has a low photosensitive base density and high sensitivity. More specifically, the purpose is to develop a copying and photographic sensitive material with a sensitivity greater than five times the present level of similar materials now on sale.

Already, a photosensitive material with a styrile pyridium group and another with a styrile quinolium group have been developed. These photosensitive materials have excellent characteristics of being sensitive to light with long waves of up to 460nm for styrile pyridium and up to 520nm for styrile quinolium.

It has reportedly been confirmed that photosensitive resins made of these materials and polyvinyl alcohol are 10 times more sensitive than conventional resins of polyvinyl alcohol and ammonium dichromate. Furthermore, only a mol percent is sufficient for either photosensitive materials. These are attracting attention as the latest materials available.

The Research Institute wants to develop film for survey drawings, design drawings and display by clarifying the mechanism by which photosensitive resins react.

It is also studying an argon laser photosensitive material and has already developed a styrile quinolium group sensitive to argon laser with wavelength of 488nm, produced by combining a resin with polyvinyl alcohol and has confirmed that the resin is photosensitive even at the low energy of 10mJ/cm^2. It is said to have also confirmed that a material sensitive to low energy of just a few millijoules can be developed if a different resin is used in combination with the photosensitive material. This photosensitive material equals silver which, at present, is considered best as a photosensitive material.

The target of the research project is to develop a photosensitive resin with a sensitivity of 1 mJ/cm^2.

When this research is completed, it will be possible to print 100,000~1,000,000 elements on a semiconductor 5~7mm square using low energy and instantaneously, and the appearance of the super LSI seems near at hand.

Much is expected of it also as a material useful for the information society since its function as a material for information processing including printing will improve. Indeed, the public is looking forward to the outcome these research projects.

CSO: 4120/105

SCIENCE AND TECHNOLOGY

COMPREHENSIVE WASTE HEAT USE SYSTEM COMPLETED

Tokyo TECHNOCRAT in English Vol 14 No 8, Aug 81 pp 41-43

[Text]

A comprehensive "waste heat use system" has been completed under the "Moonlight Plan", and R&D project to find techniques for large-scale energy conservation that has been promoted by the Agency of Industrial Science and Technology, Ministry of International Trade and Industry. This is a practical system developed as the result of a six-year ¥3 billion project with participation of 10 manufacturers in efforts to conserve energy by recovering and using by the best methods, large amounts of waste heat discharged from thermal power plants, steelworks and other factories. Since this is the last fiscal year of this project, the Agency is planning to consolidate research results by constructing a single system using a steelworks with an annual crude steel production of 8 million tons as the model. A survey and calculation of costs the effect of energy conservation, etc., will be made, and on this basis, they hope to pave the way for full-scale use of the new system. Much is expected of its far-reaching effects, since the development of energy conservation techniques is even more important to Japanese industry than the development of new energy sources.

Japan's energy consumption is said to amount to about 400 million kl annually in terms of petroleum products. But about 50% of this is discharged into the air, rivers and sea as waste heat. If even 10% of this waste heat can be recovered and used effectively, the nation can save energy amounting to about 20 million kl of oil annually. Particularly, since the mining and manufacturing industries reportedly account for 60% of Japanese energy consumption, efficient recovery and effective use of this waste heat is paramount to the nation's energy conservation measures.

Under these circumstances, the Agency of Industrial Science and Technology started research and development on a comprehensive "waste heat use system" from FY1976 as squasi-giant project, and with the start of the Moonlight Plan, stepped up research efforts to make the system practical.

A waste heat use system consists generally of developing, basic techniques for (1) heat recovery and exchange, and (2) heat transport and storage. As techniques for heat recovery and exchange, (1) techniques to recover heat by compressive heat

pumps, (2) techniques to recover heat by absorptive heat pumps, (3) techniques to recover heat from solid materials, i.e., of coke by dry quenching using an inert gas, (4) techniques to generate high-pressure gas from waste heat, (5) a technique to use a small high-efficiency rotary heat exchanger, and (6) a technique of using a moving-bed type heat exchanger using non-corrosive heat pipes have been developed and are already in a stage of actual use. In parallel with these techniques, the development of a large low-temperature heat pipe to recover low-temperature discharged heat 30–60°C, a heat exchanger for high-temperature gas, an automatic circulating heat recovering unit for industrial furnaces, and a direct contact heat exchanger have been undertaken by the Government Mechanical Engineering Laboratory, the National Research Institute for Pollution and Resources, and the National Chemical Research Laboratory for Industry.

As for heat transport and heat storage, techniques for hot water transport by thermosiphon and heat transport by chemical energy may well become practical.

The following are the technical achievements accomplished under this research project: First, there is the "waste heat recovering high-temperature heat pump system" has been produced on a commercial basis as a method for compressive heat pump heat recovery. It can recover heat from waste hot water of relatively low temperature 30–60°C and efficiently generate high-temperature water 100–160°C. Whereas, by using a conventional heat pump, hot water only 50–60°C, at the most, can be obtained, As the new system produces hot water two to three times this, it can be used not only for local heating as at present but also for regional heating and heat used by nearby industries.

The method of heat recovery using an absorptive heat pump is that, though it also uses low-temperature waste hot water 30–60°C, high-temperature hot water 70–90°C and cooling water (7– –10°C) are freely obtained by using lithium bromide at normal air pressure. This technique is most suitable for factories and regional air-conditioning.

For recovering heat from solid materials, such as coke, a rotary system to recover the heat of redhot coke, 900–1,000°C produced in making coke, adopts dry quenching using nitrogen gas. Conventionally, the heat from redhot coke is released into the air by dousing with water. Use of the new system not only makes effective use of the heat possible but also contributes to preventing pollution by eliminating dust. It is designed to move redhot coke from a hopper to a closed rotary plate (cooler grate) as the coke leaves the coke oven, and thus obtain cooled coke, by using nitrogen gas as the cooling medium to recover the heat, 750°C. The recovered heat is converted by a waste heat boiler into steam, 180°C, pressure 10kg/cm^2

The moving-bed heat exchanger is a system to remove waste and corrosive gases and dust from a steelworks converter and, at the same time, recover heat by combining a moving-bed dust collector and a heat exchanger. Since a heat exchanger of

this type, that combines dust collecting and heat storing functions, never previously existed, much is expected of it as a method for use in steelworks and cement mills.

As for results of research on methods to generate high-pressure gas using waste heat, an "oil-Freon-electric generating system" has been developed. It recovers waste heat at first by oil, an intermediate heat medium, and then uses this heat to evaporate Freon, the turbine medium, and to generate electricity by a turbine generator. It is estimated that, if waste gas in a cement mill's clinker cooler is used, 480,000Nm^3 of waste gas at 250°C gemerates 3000kW, enabling 19.3 million kWh annually to be recovered, which is equivalent to 5,300kl of oil annually.

In the development of rotary heat exchangers, a "rotary heat pipe heat exchanger" has been completed with the object of recovering heat from medium- and low-temperature waste gas 150~300°C and generating hot air or steam for combustion puposes. It is a small heat exchanger capable of efficiently recovering heat from medium- and low-temperature dirty waste gas, which previously has been impossible to use. It involves rotating a number of noncorrosive heat pipes attached to a parting strip in the form of a drum. It is claimed that, in a plant test, 2t/h of 130°C steam was obtained from 100,000 Nm^3 of coke oven waste gas at 200°C.

Apart from those heat recovery and exchange techniques, the development of methods to transport or store heat that has been recovered have been conducted under the same project. As a thermosiphon heat transport system, an energy-saving unit to move hot water without using a mechanical pump or other form of power has been developed for actual use. The principle is to use a thermosiphon that can cause a two-phase flow of gas and liquid by using part of the waste heat 120~400°C, and its merit consists in being able to move large amounts of heat in the form of hot water. In this research, a thermosiphon test plant with a riser 15cm in diameter and more than 20m high, and a pilot plant comprising a 300-m circulating loop were completed; much test data were gained from this experiment, though when the flow decreased somewhat, the amount of available heat decreased accordingly, but the result showed that the system is quite practical.

Fifty-four Japanese patents and utility models and three overseas patents have been applied for in connection with the development of the various waste heat use systems. Many of these techniques have been made practical by combining not only material techniques but also most up-to-date techniques, Now that development of all the basic techniques concerning the project has been completed, the Agency of Industrial Science and Technology, as mentioned earlier, is planning to design a single system composed of all these elementary techniques using a steelworks with an annual crude steel production of 8 million tons as the model, and use this system to continue further research on actual energy conservation effects and to check costing of the techniques. The whole project will be completed by the end of the current fiscal year.

CSO: 4120/105

SCIENCE AND TECHNOLOGY

TOSHIBA COMPLETES FULLY AUTOMATED PRODUCTION OF IC'S

Tokyo TECHNOCRAT in English Vol 14 No 8, Aug 81 pp 47-48

[Text]

Toshiba Corp., at its Kitakyushu plant, has completed a fully automated fabrication system under computer control for bipolar integrated circuits, and the system is now in full operation. This is a 3-stage control system with a TOSBAC 7/40 computer at its core, under which, three minicomputers and 74 our microcomputers are interconnected. All preprocessing, such as lithography, diffusion, ion injection, and CVD, is controlled based on through control information.

Toshiba has decided to introduce automated production of bipolar IC's eariler than for MOS IC's, because of greater benefits. Toshiba is said to have spent five years and ¥3 billion for development.

Three points have greatly contributed to system development as follows:

(1) There were so many control elements that a thorough investigation was necessary to allow a test pattern on a wafer to be read accurately.

(2) Interface to freely connect each unit was newly developed.

(3) An online monitor to measure film thickness was developed.

The system has brought about the following effects:

(1) Production losses between lots have been reduced to half by process control of each production process under an optimum condition while providing feedback control status of any other process stage.

(2) Time lost between processes has been reduced and overall production time has been shortened.

(3) Quality variations and operational errors caused by human factors have been eliminated.

(4) Operation with human intervention has been reduced and the degree of cleanliness overall has been vastly improved.

(5) Centralized monitoring of production processes has improved operational efficiency of facilities and flexibility in production planning.

These effects have improved production yields 10 to 15 percent better than previously and production time has been reduced by 20 to 40 percent. In addition, only three persons are required in the photo resist process, one-third of that previously. Production has doubled in volume over the previous year with the same staff. Configuration of the entire system is as shown

in Fig.1 and the total line is managed centrally. For example, a CRT terminal is placed at each group of devices such as diffusion, lithography, ion injection, and etching.

Control for each process is as indicated in Fig.2, and conditions in the previous process are taken into consideration in the next stage to obtain optimum accuracy.

The new lines can keep yields of current amplification, a factor that is a problem for bipolar integrated circuits, within the range of two for a given value, against three or four previously.

At present, 60 percent of the Kitakyushu plant has been automated and in future Toshiba intends to apply the new system to the remaining lines. It also intends to include the system in the new lines for super LSI MOS that were completed at its Oita plant.

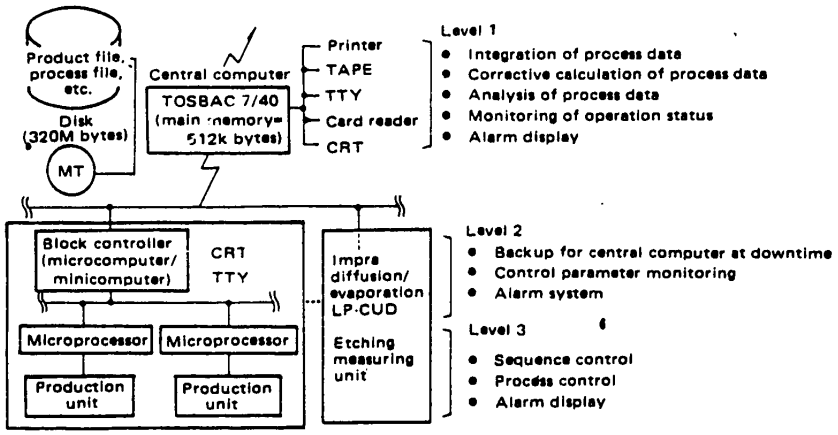

Fig. 1. Toshiba's Automated Production of IC's

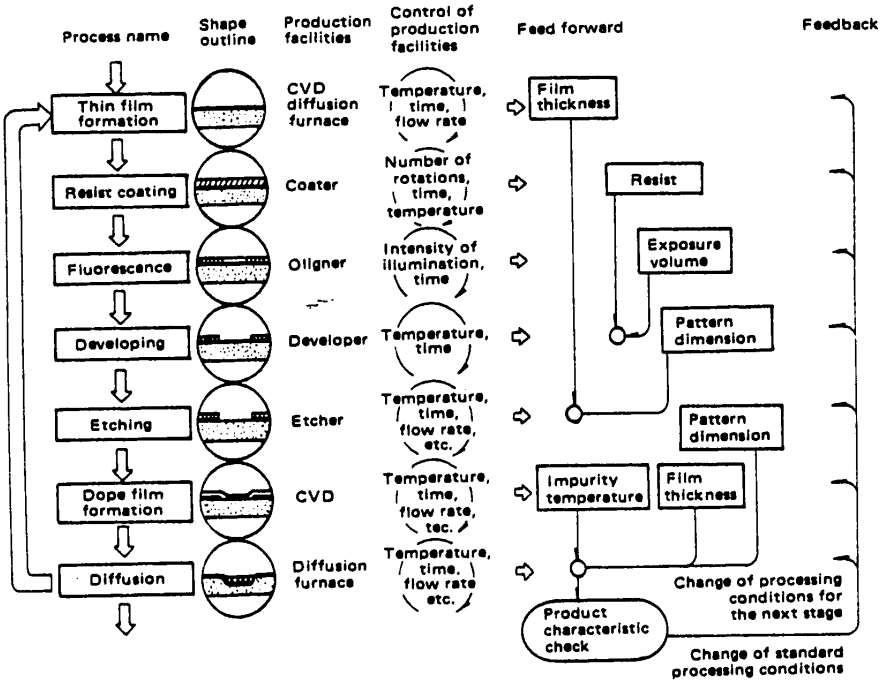

Fig. 2. Process Control Conceptual Diagram

CSO: 4120/105

SCIENCE AND TECHNOLOGY

MECHANICAL ENGINEERING LAB DEVELOPS TRANSFER ROBOT

Tokyo TECHNOCRAT in English Vol 14 No 8, Aug 81 pp 50-52

[Text]

The Mechanical Engineering Laboratory, Agency of Industrial Science and Technology, has developed a robot that travels along a path by following three kinds of instructions, of posture angle, position and judgment, from marks corresponding to traffic signs posted intermittently along the route.

At present, conveyance of goods in a manufacturing plant is mostly done by belt conveyors. A belt conveyor is best suited for conveying large quantities of goods continuously but it suits only an exclusive route, thus making it impossible to make best use of floor space. With the system, usually the the path cannot be easily changed.

The transter robot was developed with a view to making better use of floor space as well as providing for changes of route. The following is an outline of the robot.

To give the transfer robot running functions, such as to proceed straight ahead on a straight path, make a left or right turn, or to proceed straight ahead an intersection, make a stop at a designated point – functions which are required for the robot to travel along a predetermined path, 16 kinds of symbols each corresponding to a traffic sign, are used. These marks have varying features, and they are roughly classified according to the size of their surface areas. Mark 1 and Mark 92' have an identical area ratio of 4. To tell the difference between the two marks, shown in Fig.1, the different values of the specific shapes calculated from Formula (1), are given by three features – the extent of maximum width A_x in X direction, maximum height A_y in Y direction and area A_a – in the projection drawing drawn by a projection incident on the base line, are verified for judgment.

$$S = \frac{A_a}{A_x \cdot A_y} \quad (0 \leqq S < 1) \qquad (1)$$

From width A_p in X direction that becomes the largest in Y direction and maximum width A_x in X direction, in the projection drawing in Fig.1, the posture angle is obtained from the measured values given by Formula (2).

$$Q = \frac{A_p}{A_x} \quad (0 \leqq Q \leqq 1) \qquad (2)$$

Table 1. Various Marks

Mark number	Shape	Area ratio	Function	Mark number	Shape	Area ratio	Function
1		4	Proceed straight (AP)	72			6 stop at intersection
2		1	Proceed straight (P)	8		2	Stop (P)
3		8	Left turn at intersection	9		6	(A.P) Destination (T) (P)
4		7	Right turn at intersection	9'		1	
5		7	Proceed straight through intersection	91		5	(A.P) Destination (E) (P)
6		3	Intersection	91'		2	
7		4	Stop at intersection	92		3	(A.P) Destination (E.T) (P)
71		5	Stop at intersection	92'		4	

A.P : Correction of the posture angle and position
T : To start after lapse of a certain time
E.T : Outside start botton and to start after a certain period
P : Correction of position
E : To start upon pressing the external start button

Fig.2 shows the relationship between the posture angle measured value and posture angle in an isosceles triangle. Using this value, the posture angle is determined to be in the range of $-\alpha \leqq \theta \leqq \alpha$ if α is given as the semiangle of the vertical angle of an equilateral triangle.

The transfer robot (Fig.3) is about 70cm across and about 130cm long, and weighs 200kg. It can carry a maximum load of 250kg. Comprising a three-wheeled car, a front wheel and two rear wheels, it is battery powered. Rear-wheel driven, it runs at constant speed, 7.5m/min, and it is steered by the front wheel. It has an ITV camera for mark recognition mounted vertically and facing downward. For controls, the transfer robot employs minicomputers to perform mark recognition and steering.

In running the transfer robot, instructions are input using a typewriter to instruct which path to use. When the start button is pressed, the robot proceeds straight if the mark is a straight sign, and makes corrections in its direction by judging which

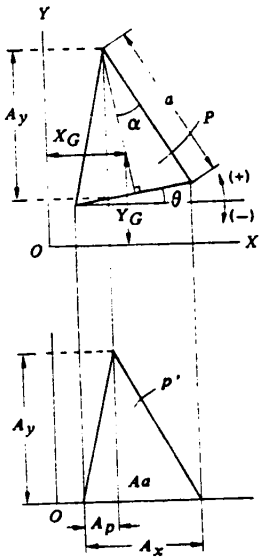

Fig. 1. Extraction of Mark Characteristics

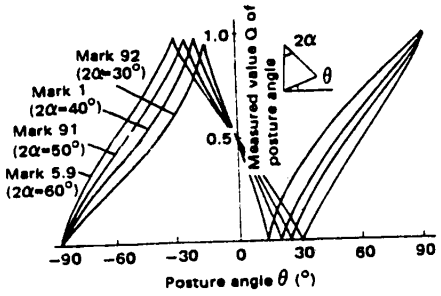

Fig. 2. Measurement of Posture Angle

direction it is proceeding to from which way the mark indicates. At the entrance to an intersection are posted such marks as "Stop," "Turn right," "Turn left" or "Proceed straight" so that the robot can determine the direction in which it can advance, and then proceeds as instructed. In case there is no right-turn mark although it has been instructed to make a right turn, the robot automatically stops at that position. Upon arriving at the instructed destination, the robot stops there for a period and then resumes its advance to the next destination.

In the currently developed transfer robot, cables are used to

connect the robot proper with a minicomputer. However, since a microcomputer has ample capacity to provide control, this new robot with a microcomputer mounted is able to travel without cables. Furthermore, if the robot is equipped with a manipulator, it will be able to perform loading and unloading of cargo.

As future research tasks, the Laboratory is considering the robot's application to operations in environments inaccessible to humans, such as nuclear reactors, and to unmanned transport cars in plants.

CSO: 4120/105

SCIENCE AND TECHNOLOGY

SEMICONDUCTORS, RELATED INDUSTRIES REACH ¥1 TRILLION LEVEL

Tokyo TECHNOCRAT in English Vol 14 No 9, Sep 81 pp 49-50

[Text]

According to the "Production Forecast of the Electronics Industry in 1981" prepared by the Electronics Industries Association of Japan at the end of 1980, in 1981, Japan's semiconductor industry will reach the trillion-yen level for the first time. If electron tubes, such as cathode-ray tubes, are excluded from "Production Forecast of Active Parts in 1981" based on MITI's statistics of production, the remaining are semiconductor devices and integrated circuits, and the total value exceeds ¥1 trillion.

Let us look at the actual figures. For integrated circuits, they have grown from an estimated ¥568.3 billion in 1955 to ¥725.9 billion in 1981, a 27.7% increase. For semiconductor devices, the growth rate is 12.1% of ¥291.3 billion in 1980, amounting to ¥326.6 billion in 1981. Both put together show a 22.4% increase, amounting to ¥1,052.5 billion (after the 1980 results were announced, the growth rates of integrated circuits and semiconductor devices showed 27.3% and 11.9% respectively).

When this forecast was announced last year, the U.S. semiconductor market was in the middle of a depression and it was predicted that the U.S. semiconductor industry would maintain bipolar devices in good growth condition for 1981, but it could not expect MOS to grow, considering growth would be 5% including discrete devices, though in total, integrated circuits would be 6% up. Some in Japanese industry, thought it difficult to expect a growth of 22%, and that the figure was too high to achieve. However, according to a recent survey made by the Daily Industrial Newspaper for 1981 (partly the calender year), production plans show that it is almost certain that the industry will enter the ¥1 trillion industrial group this year. That is, NEC, Hitachi, Toshiba, Matsushita Electronics Industries, Fujitsu, Mitsubishi, Sharp, Tokyo Sanyo Electric, and Oki - with only these nine major semiconductor suppliers, the results will be ¥1,093 billion according to their 1981 production plans, at the same time showing a 27% increase over last year's level. Thus, together they will leap over the ¥1 trillion hurdle. In addition to these companies, if middle class, in-house, and foreign-owned suppliers, such as Sony, Fuji Electric, TI Japan, Suwa Seiko-Sha, Toyo Electrical Tool Manufacturing, Toko, New Japan Radio, and Sanken Electric, are included

production will surely reach the ¥1 trillion level plus several hundred billion within 1981 or the fiscal year.

It is thirty-five years since domestic production of transistors started and IC's have only a 16 or 17 year history. Nevertheless, it should be noted that the semiconductor industry will soon be a member of the ¥1 trillion industrial group with its high growth rate, particulary, the notable is the growth of IC production over the last three years. The production of ¥208.5 billion in 1977 grew to ¥281.4 billion in 1978, to ¥382.9 billion in 1979, and to ¥570.2 billion in 1980. Production has doubled in the three years since 1978. The growth over the previous year was a 35% increase in 1978, 36% in 1979, and 49% in 1980. The high growth rate of over 35% shows in succession and it is outstanding progress.

This reveals that production of IC's is a rapidly growing industry. Indeed it has high growth, but this industry has not always enjoyed such a rosy path. The semiconductor departments of mosts electric companies have commonly been thought of as: "Not profitable" or "Monery-eating bugs." History repeatedly showed two-or three-years of prosperity and then one-year's depression.

For example, in 1970, the IC industry produced MOS devices, but then dropped to minus growth in 1971. It tided over this situation with LSI technology used in electronic calculators, then rapidly grew again from 1972 to 1974. It also dropped to minus growth in 1975 because electronic calculators reached saturation. Afterwards, it was restored by applying IC's to consumer products such as TV's, the rapid increase of exports and MOS devices used in IC's for memories. It showed a 68%

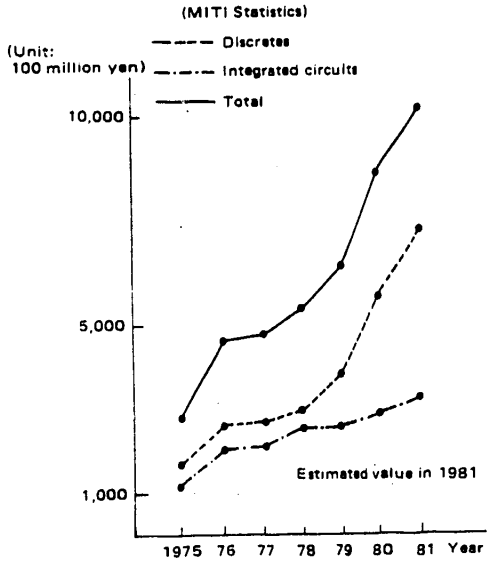

Fig. 1. Production Value of Semiconductors in Japan

increase in 1976, but the growth was only 6% in 1977 because of the second oil shock. The above are the figures of the IC industry for the three years before. For such a history, the industry is not only pleased to reach the ¥1 trillion level. However, IC's have been used mainly for consumer products and now it is the growing industrial sue, such as in computers and controls. With this trend, microcomputers are being widely used and IC's have rapidly penetrated our society. They have now become completely indispensable, so, therefore, not much influenced by economical changes. As labor saving, energy saving, and new product development are becoming more active in depression years, the demand is found to grow. This has lead to the higher stable growth over the past three years.

However, one big wave that swallows the industry in a difficult situation does not easily disappear. The rapid drop of 16-k memories is a recent example. Until spring last year, 16-k memories had been in short supply worldwide and Japanese suppliers had been quick to earn good profits with increased production. But after the spring in 1980, the situation completely changed to over-supply, and prices started to drop. suddenly. A unit had cost from five to six dollars, but continued to fall in price at the rate of one dollar every two months. Six months later, at the year-end, the price had fallen to two dollars or less, 1/3 of the original price. With this, the U.S. semiconductor industry entered a state of depression. It was said to require one year for recovery.

The Japanese semiconductor industry was directly affected by this depression in the United States, because the U.S. market held a 60% share of the demand worldwide for semiconductors and particularly, over 65% of the demand for the memories that Japan was good at fabricating, and was thus dependent upon the U.S. market. Each company here took a prudent attitude towards this year.

However, Japan's domestic market is still in good condition, mainly for consumer products, and it has the advantage that microcomputers, linear IC's for TV's and audio equipment, and small signal transistors for VTR's and video disks can be expected to continue to grow this year. The Japanese market will not go down as has the U.S. market.

The B/B ratio (ratio of orders received to shipments) that was the preceding guideline for business conditions has improved in the U.S. market from the beginning of this year, and there have been some hopeful signs of recovery since last April. Thus, IC's for industrial use in the United States that were reduced in production can after the summer, be expected to grow rapidly, including those new devices such as 64-k memories. Some signs have begun to appear of revival of sales both for industrial and consumer use in the same way as at the best time in the previous year.

If so, over a 30% increase of IC's sales can be forecast for four years in succession. The semiconductor industry can be said to be enjoying a prosperous year in 1981.

CSO: 4120/103

SCIENCE AND TECHNOLOGY

NTT DEVELOPS STEP-AND-REPEAT X-RAY EXPOSURE SYSTEM

Tokyo TECHNOCRAT in English Vol 14 No 9, Sep 81 pp 50-51

[Text]

The Electrical Communication Laboratory of NTT (Nippon Telephone and Telegraph) has been developing a new X-ray exposure system in order to narrow the minimum line width of patterns for the manufacture of VLSI's. Recently they successfully concluded development of a practical step-and-repeat type X-ray exposure system named SR-1, which can transfer patterns of 0.5μm width.

It is necessary that line width in VLSI's become narrower and narrower to make high performance VLSI's, and at present it is necessary to establish a technique to obtain a pattern of submicron width below 1μm. This new system, SR-1, which can transfer submicron patterns by X-ray exposure, heretofore considered to be difficult, will from now considerably promote the development of VLSI's by high-speed transfer.

Pattern formation in the X-ray exposure method is to transfer the pattern of a mask to a wafer using X-rays, the pattern of which is formed by electron beam exposure. The method has two merits: one is minor scattering and good resolution, enabling narrowing of pattern width, because the energy of X-rays is less than that of an electron beam; and the other is low loss in the production of VLSI wafers and good reproduction because thick resist over 0.5μm can be used. These merits all help to form fine patterns in the submicron range.

However, there arises one important problem, that to maintain precise positioning of the mask and wafer, which has to be repeated many times in the manufacturing process.

In practice, it is necessary to have an accuracy less than ±0.1μm in position alignment, and an accuracy of 10μm±1μm of the space between mask and wafer, in order to transfer a multiple mask pattern with line width of about 0.5μm. But, the wafer to be irradiated, becomes distorted in various ways (expansion, shrinkage, and bending) during the manufacturing process. This distortion makes it difficult to maintain high accuracy by previous transfer methods, which adjust simultaneously all positions over the whole wafer, and so previously there had been no development of X-ray exposure equipment for VLSI's suitable for transferring submicron patterns. SR-1, is a step-and-repeat type X-ray exposure system which is quite

Table 1. Specifications of the Step-and-Repeat Type X-ray Exposure System SR-1

Performance	Resolution	0.5μm
	Alignment accuracy	±0.1μm
	Wafer size	3 inch, 4 inch
Construction	X-ray wavelength	7.1Å (Si-Kα)
	Source-wafer distance	120mm
	Mask-wafer spacing	10μm±1μm
	Environment	Atmosphere
X-ray source	Water-cooled rotary target	150mm diam. 6000rpm
	Excitation voltage	~20kV
	Beam current	~1A
Aligner	Position detection	Video signal processing
		Method (resolution
	Step and repeat mechanism	Moving coil type linear Motor driven
		Air bearing guided stage
		Stroke 100mm×190mm
	Alignment mechanism	Resolution 0.05μm

practical in transferring submicron patterns. A pattern, with a minimum line width of 0.5μm, can be transferred by SR-1 with an accuracy of mask alignment of ±0.1μm on wafers 3 inches in diameter, and it can handle more than five wafers an hour.

An outline of the new technique mentioned above, is as follows:

Working accuracy in position alignment is determined by the object area on the wafer for alignment, accuracy of moving the wafer, accuracy of the space between the mask surface and wafer, and the accuracy of measurement. As for the object area for position alignment, the area of the wafer to be irradiated is divided, and the wafer is moved for each division and alignment of the wafer to mask is with high accuracy for each move. Then the wafer is irradiated, and the process is repeated. This is the step-and-repeat method. In developing this method, a moving coil type linear motor is used to drive an air-driven stage, serving both mechanisms of moving and positioning. Because this mechanism has no mechanical contact in the drive and bearings, it is possible to achieve high accuracy, both for moving and that of the space between mask and wafer, and thus that of alignment of the mask. As for the mask, it is desirable to have a large diameter, as long as high accuracy can be maintained, but it is necessary to have a thin film of 2 to 3μm for high transparency of the X-rays. Heretofore, a large mask with a diameter of 10mm was easily distorted or broken, and so, it had been considered to be difficult to prepare and adjust masks with large diameters. In developing SR-1, a silicon nitride mask, having increased strength, was adopted as the mask plate, and so, even if it is large in size with a diameter of 30mm, a mask with less distortion and good reproduction was available, and it became easy to maintain the space between mask and wafer at 10μm.

To improve further the accuracies of aligning mask and wafer, and determining the space between them, the laboratory has developed an optical system for detecting position and space at the same time. In this system, the fitting marks of the mask and wafer are projected simultaneously and enlarged on an imaging tube by a microscope having a double focused lens. Then, by treating electrically the video signal, the position marks of mask and wafer are detected simultaneously. On the other hand, as the conditions of adjusting focusing of both marks from the above video signal, both marks of the mask and wafer are focused to both focuses of the double focused lens, thus determining the space distance. By this method, it has been possible to provide high accuracy for detecting the fit of positions less than ±0.05μm, and detecting the space at less than ±0.3μm.

To obtain high speed, an X-ray source having high brightness has been used. A small diameter electron beam radiated to the X-ray target, 3mm, and exciting voltage of 20kV, have been used. As for the exposure atmosphere, the method of exposing in air has been adopted to maintain good operating conditions and to shorten exposure time. Besides, the time for moving position by the aforementioned new mechanism, within an accuracy less than ±0.1μm, is less than 0.5 sec each exposure. The large size of the mask also contributes to the high-speed operation. And the success of the mask suggests the possibility of exposure to a larger chip with a side longer than 10mm.

Specifications of SR-1 are shown in the table.

This system can handle more than five wafers of 3 inches diameter per hour besides a 4 inch diameter wafer, and it is the first system in the world as a practical X-ray exposure method for transferring submicron patterns, and so, will be expected to be a powerful tool in the development of VLSI's. The laboratory will extend its research to obtain further high-speed operation.

CSO: 4120/103

SCIENCE AND TECHNOLOGY

DIGITAL AUTOMATIC DLTS MEASURING DEVICE DEVELOPED

Tokyo TECHNOCRAT in English Vol 14 No 9, Sep 81 pp 52-53

[Text]

A research group, headed by Professor Kanno, Mr.Asada and others, of the College of Engineering, Tokyo University, currently has succeeded in developing the "Digital Automatic DLTS Measuring Device." The device, which utilizes a time sharing type control method based on various parameter measurements, with help of a microcomputer, has succeeded in reducing current DLTS measuring time to approximately 1/50. DLTS is an effective method to measure deep traps in silicon and chemical compound smiconductors. A trap means an energy level in the prohibitive zone which delays a carrier temporarily.

Naturally, any help to determine a semiconductor's characteristics and improve yield rates is welcomed. In the past, measurements were processed by such analog devices as a "box averager," an integrator which utilizes box-type functions. In addition, analysis was rather lengthy, approximately one week, because it required several temperature sweeps for analysis. News of this development for automated measuring technology is attracting much attention from waifer and LSI manufacturers who will be able to use the new DLTS measuring device as an improvement to their production processes.

The DLTS measuring principle is as follows:

When a deep trap exists and a pulse is applied, hourly variations appear as a trap's capacitance value. In actual measurement operation, sample components such as P-N and combinations, and various MOS diodes are placed in a cryostat. When a constant wave form of an applied pulse is added to the samples, capacitance variations are measured repeatedly by a capacitance meter, then final averaging and reducing of the measurements into usable data are performed.

Formerly, all of such measurements, as well as data processing, were performed by analog devices only. One measurement required approximately 1 to 2h, the time necessary to raise the temperature up to 200K in the absolute temperature scale. During measurement, a sample point on the applied voltage and capacitance must be fixed at a certain value then temperatures of the cryostat are slowly swept. Usually one temperature sweep is insufficient to obtain all necessary data for analyzing trap energy levels, catching cross-sectional areas of the carriers, analyzing depth distance distribution from the trap

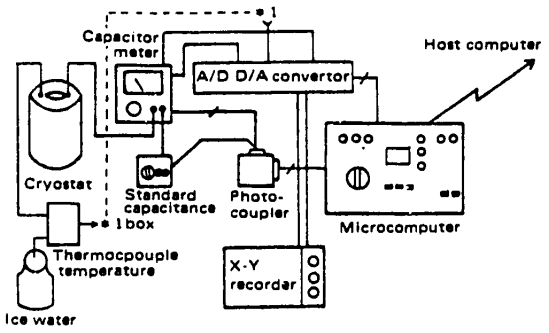

Fig. 1. Outline of Digital DLTS System

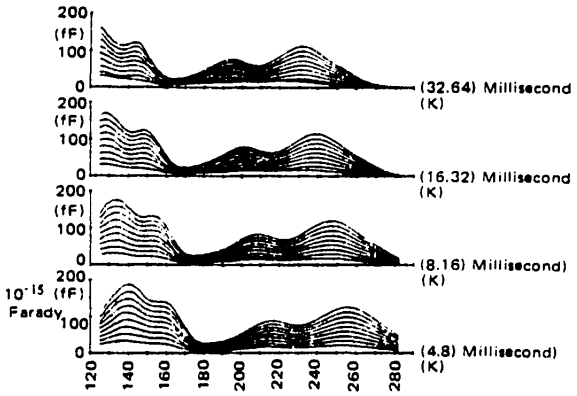

Fig. 2. Example of Spectrum by DLTS (Analyzing a deep a deep trap by inclination of the line connecting ajoining mountains.)

boundary surface, and others. As this procedure often requires changing the voltage wave forms and sample times of the capacitance, several temperature sweepings are necessary and it takes a very long time to perform. Moreover, basic characteristics of the analog devices are very difficult to retain in constant condition.

In order to overcome such difficulties, the research group succeeded in obtaining all the necessary data on a DLTS by single temperature sweeping. In order to achieve such results, the device has been utilizing advanced control capability of a microcomputer which is able to supervise any variation of applied pulse, bias voltage, time, and other various parameters, by the time sharing method. These sequential parameter groups also include such three sweep schemes of hourly sweep (Multipoint sampling), voltage sweep (multitype applied pulse), and temperature sweep. As quick sweeps are able to disregard any temperature variation during such a short time of the experiment, all necessary measurements are taken under rigid control of various complicated parameter fluctuations by the micro-

computer. These sweep parameters are multipoint samplings of the capacitance response (hourly sweeping) and multi type applied pulses which vary the applied pulse heights and bias values under a certain relationship (voltage sweeping.)

As all of these measured values are stored in the memory of the microcomputer, the difference of the capacitances of two adjoining sample points are calculated sequentially and integrated instead of the former boxcar's averaged calculation, then it actuates the integration counter. In addition, the necessary absolute capacitance measurement of a sample for space distribution calculation of trap levels along with ordinary DLTS data is performed by the DLTS device. The absolute capacitance measurement is separated from the basic capacitance measurement system by a relay and inserted into the DLTS measuring operation. Thus, the system is now able to acquire all necessary data for DLTS and is capable of processing their following analyses and comparison of data with the theoretical values and others by simply being integrated with a host computer.

CSO: 4120/103

SCIENCE AND TECHNOLOGY

RECENT DEVELOPMENTS IN AMORPHOUS METALS RESEARCH REPORTED

Tokyo TECHNOCRAT in English Vol 14 No 9, Sep 81 pp 53-55

[Text]

Research on amorphous metals, known to many as "dream magnetic alloys," is underway, and the companies that have been entrusted with this research by the New Technology Development Foundation, and who have recently had success, are as follows:

a) Matsushita Electric Industrial Co., Ltd. – "Applied Technology for Amorphous Metals" (such as high-permeability materials.)"
b) Hitachi, Ltd. and Hitachi Metals, Ltd. – "Production Technology for Amorphous Metals for Electromagnetic Materials"
c) Sony Corp. – "Applied Technology for Amorphous Metals (such as high-magnetostrictive materials.)"

1. "Applied Technology for Amorphous Metals (such as high-permeability materials.)" – Matsushita Electric Industrial Co., Ltd.

Until now, for magnetic heads such as in taperecorders, etc., ferrite and permalloy have been used, but since ferrite is inferior in magnetic characteristics, while permalloy is inferior in wear resistance, neither material is suitable for forming into a metal strip that later, can be formed into heads capable of carrying out high-density recording. As to what current material is suitable for this purpose, there is "Sendust", at present used in magnetic heads, which is obtained by forming the material Sendust, into sheets, laminating the sheets, then using the laminate as the magnetic core of such heads. However, because Sendust is very brittle, there have been problems, such as the difficulty of processing the material into sheets.

On the other hand, an amorphous metal obtained by quenching a metal while molten, is irregular in molecular structure and without grain boundaries. Therefore, it has excellent characteristics unseen in conventional metallic materials.

These characteristics are much affected by any alloy components of an amorphous metal, but by properly selecting the alloy components, a material high in both permeability and electric resistivity can be obtained. Therefore, a magnetic head

formed of this amorphous metal has excellent characteristics, in that it has low high-frequency loss.

However, for an amorphous metal having such characteristics as being unstable to heat and high hardness, many factors need to be solved to make it practical and development of technology to overcome such undersirable factors has been strongly required.

Technology that has been recently developed, comprises producing a strip of an amorphous metal having high permeability, then processing such a strip into a magnetic head, excellent in high-frequency magnetic characteristics while offsetting its shortcomings as an amorphous metal.

In this technology, many steps are taken in order to meet the conditions for the material to be suitable for magnetic heads. Namely, in order to impart low magnetostrictive retentivity at high permeability to such an amorphous metal, a material of the cobalt-iron-silicon-boron series has been adopted. To raise saturated magnetic flux density, manganese is mixed, then to prevent rust caused by humidity and heat, chromium is also added, resulting in an amorphous metal strip having permeability of 20,000, a saturated magnetic flux density of 9,000 gauss (G) and a magnetic coercive force of 0.005 oersted. This strip is 5cm wide and 30~50μm thick, and when it is made into a laminated magnetic core, the surface roughness is controlled to within $\pm$2μm in order to decrease volume of the laminate and make bandwidth occupancy at least 90%.

However, in its present states, the magnetic characteirstics age and thermally it is unstable, therefore, the amorphous metal is subjected to heat treatment at 400~450°C to prevent the magnetic characteristics from aging, or changes made because of heat.

A number of strips of this amorphous metal are laminated to form the magnetic core of a magnetic head. This amorphous metal has a hardness of 900 Vickers, or being very hard, but in spite of this, it is still inferior in wear resistance, and as much as 20μm is worn away when in contact with a sliding tape for 1000 hours. Therefore, as an adhesive for laminating, as for a magnetic head, hard oxidized particles, such as iron and aluminium oxides, are mixed with a binder to improve wear resistance, resulting in reducing wear by abrasion to 4μm/1000h.

In mass production of these magnetic heads, in order to produce the laminates to size from the amorphous metal strip, it is desirable to adopt punching. However, because the metal strip is hard, a die is easily deformed thus tending to generate burrs, and therefore, punching is unsuitable. To overcome this weakness, chemical etching is used to cut the necessary laminations.

And so the magnetic head of amorphous metal is excellent in magnetic characteristics, which when compared with those of the conventional magnetic heads, the results are shown in Table 1.

An amorphous metal magnetic head having far superior magnetic characteristics to "Sendust" is now available and can be used as magnetic heads for audio use besides that for VTR's and computers, and in future is expected to develop usefulness far high-density recording.

Table 1. Comparison of Magnetic Head of Amorphous Metal with Conventional Magnetic Heads

Materials / Characteristics	Amorphous	Sendust	Permalloy	Ferrite
Restoring sensitivity (315 Hz)	−71 dB	−71 dB	−73 dB	−73 dB
Regeneration frequency characteristics (14 KHz/33 Hz)	+17 dB	+15 dB	+13 dB	+15 dB
Low-zone MOL	+ 4 dB	+ 4 dB	+ 2 dB	0 dB
High-zone MOL	− 1 dB	− 2 dB	− 4 dB	− 6 dB
Distortion factor	1%	1%	2%	5%
Bias current	4μm	5μm	100μm	1μm

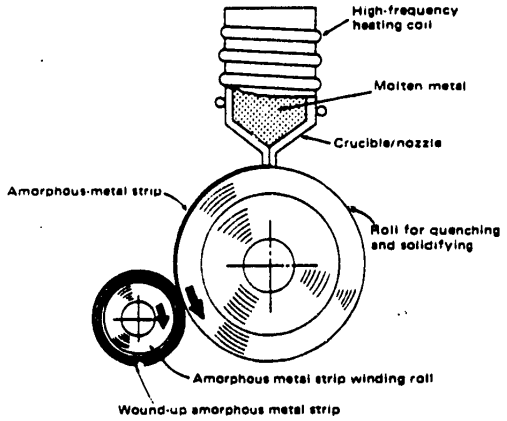

Fig. 1. Conceptual Drawing of Equipment for Producing an Amorphous Metal Strip (the monoroll method)

2. "Production Technology for Amorphous Metals for Electromagnetic Materials" – Hitachi, Ltd. and Hitachi Metals, Ltd.

In order to produce commercially, an amorphous metal, a roll quenching method is effective, and such a method has been developed by the Hitachi group and is called the "monoroll method." This method comprises releasing molten metal from a slit-shaped nozzle onto the surface of a high-speed rotating cooling roll to form the metal into a thin strip, while quenching and solidifying the metal.

In this method of directly producing an amorphous metal strip from a metal in the molten state without it passing through a rolling stage, the main endeavor has been to develop control technology, especially for minimizing variation of thickness of the amorphous metal strip and to obtain the best

possible surface. In this development, a high-precision control system has been developed for this purpose.

A second point in production technology of this amorphous metal strip, has been development of technology for simultaneously producing and winding the strip automatically which had been regarded as difficult. In this development, a special winding system has been adopted, whereby this amorphous strip, produced at the high speed of about 30m/s, is caught instantly and taken up on winding roll.

In addition, another important point in respect of commercial production, is to establish an alloy composition easily handled by the production method while being excellent in electromagnetic characteristics, and for this, various alloy compositions exhibiting desired characteristics according to their use and method of manufacture have been established.

By this, technology capable of stably producing an amorhpus metal strip 20~55μm thick, 100mm wide and at least 300m long desired as industrial material has been established. As to applications of this ribbon in the electromagnetic field, iron cores for windings, transformer cores for high frequency, magnetic heads, and magnetrostrictive applications are conceivable, and by establishing this technology, a great expansion infields related to the use of amorphous metal strip can be expected.

3. "Applied Technology for Amorphous Metals (such as high magnetostrictive materials, etc.)" – Sony Corp.

In recent years, along with the progress and increased use of digital technology, such as in microcomputers, demands for handling material recorded graphically, are increasing and for input of such, generally a coordinate reader is used.

Most coordinate readers are of the type using a magnetostrictive delay line and as a material for a delay line, a thin alloy line composed mainly of iron and cobalt, sold under the trade name "Vickalloy," is used. This Vickalloy line is a polycrystalline magnetostrictive alloy, which has mooted points in damping of a mechanical signal (sound wave) in the grain boundary with the occurrence of noise giving a limit to development of larger size, high-performance coordinate readers having a high-disassembling capacity. As to the production of a Vickalloy line, it fails to meet the dimension and coordinate reading precision required by users. In addition, a production method capable of carrying out large-scale production has not been established, therefore, it has become an obstacle to expanding the use of coordinate readers.

Recently developed technology uses a newly developed amorphous high-magnetostrictive delay thin line instead of that using Vickalloy, whereby the difficulties mentioned are solved, thus making it possible to expand the use of coordinate readers.

The amorphous high-magnetostrictive thin fine line has, as compared with conventional Vickalloy, the following characteristics:

(1) Because it has a large electromechanical coupling coefficient, it has excellent drive detecting efficiency of ultrasonic waves.

(2) Because it is amorphous, it has no grain boundaries and thus little damping dissemination of sound waves and causing noise.

(3) Because it is a thin strip with high electrical resistance, slip current loss when disseminating sound waves is small and damping is small up to high-frequencies.

As the material has these characteristics, it is possible to produce a large-size coordinate reader having high analyzing capacity.

As to producing such a material, a triple roll method, developed by Sony Corp., applies pressure of the roll surfaces between each other, to molten metal flowing in the form of a thin band from a nozzle. The metal passes between two rolls rotating at a high speed, quenching and rolling the metal, and subsequently cooling it by a third roll to produce an amorphous metal strip. By this it is possible to produce on a large scale, a strip whose both surfaces are smooth and which has dimensional precision of 1±0.05mm in width and 0±2μm in thickness, making it possible to use the strip for a coordinate reader requiring almost no post-processing.

As a result of this development, it is possible to establish the basic technology, making it is possible to develop a large-size, high-performance coordiate reader having an effective area of 800 x 800mm, analyzing capacity of 0.05mm (possibly down to less than 0.1mm).

CSO: 4120/103

SCIENCE AND TECHNOLOGY

SEVERAL NEW FACSIMILE MACHINES APPEAR ON MARKET

Tokyo TECHNOCRAT in English Vol 14 No 9, Sep 81 p 72

[Text]

* Nippon Electric Co. has announced six new facsimile machines, called Resident Facsimile Digital, which should be appropriate for local governmental use, such as, sending copies of family registration records and of other certificates. Their transmission speeds are twice that of conventional machines and they can transmit white, black and an intermediate tone, gray. Their prices range from ¥2.45 to ¥4 million.

Matsushita Denso Company has announced Pana-fax 4800, which is a medium-speed machine and can transmit copies automatically. It is small and compact, and can exhibit black, white and an intermediate tone, gray, and is of the thermosensitive recording type. Its price is ¥780 thousand.

Matsushita has also announced a color facsimile for computer output, which has seven basic colors and eight shading tons. The company has sold it to Tokyo Electric Co. at about ¥8 million, including connections.

Toshiba has announced a new product, COPIX 7700, the highest-graded thermosensitive facsimile. Its main features are: high-speed thermosensitive with error – free retransmission, lower running costs due to being the thermosensitive type, adjustable to smaller paper size, many automatic and other miscellaneous optical functions. The price is ¥4.95 million.

Hitachi has announced two new types of facsimile in the HIFAX705 series. Their features are: showing the number of the called party on a LED indicator, recording date, time, sender's number, and the number of pages on the tip of copies received, and recording all relevant data for handling on an output printer. The other remarkable point is to apply a modified lead system, which can realize a faster transmission speed, with a 10 to 20% increase. Their prices are ¥2.3 and 2.7 million.

A smaller and more compact facsimile for use on ships has appeared on the market. Furuno Electric Co. has announced FAX-108, the depth of which is only 17cm. Its weight and size are about one-third of conventional units. The use of a synthesizer, instead of the crystal system, is helpful to reduce its weight and size. The price is ¥650 thousand.

CSO: 4120/103

SCIENCE AND TECHNOLOGY

1980 REPORT OF NTT ELECTRICAL COMMUNICATION TECHNOLOGY COMMITTEE DISCLOSED

Tokyo TECHNOCRAT in English Vol 14 No 9, Sep 81 p 72

[Text] * NTT's (Nippon Telegraph and Telephone Public Corporation) Electrical Communication Technology Committee has recently submitted to its president the following six items as a report for 1980: (1) reliability evaluation technology for outdoor facilities; (2) efficiency and economization technology for an underground distribution system; (3) signal processing technology for outdoor facilities; (2) efficiency and economization technology for an underground data communications; (5) technological problems of the portable telephone system; and (6) organization of an image communication network in the future.

More specifically, concerning item (4) above, "Future prospects the audiovisual information processing in data communications," it proposes that priorities should be given to (a) the development of technologies for industrial application of voice synthesizers, creation of voice files, and establishment of synthesized-voice quality evaluation methods, and (b) energetic promotion of technology for voice recognition via the telephone network.

Concerning the facsimule communication network related to item (6) above, "organization of an image communication network in the future" the report states that the telephone network facility should be used between terminals and the subscriber's line swtichovers and that the digital transmission network should be used between the storage switchboards, thereby providing integrated organization for the time being, and as the service network expands, the digital switching network be provided for the economization and wider use of the network. As for the image communication network, it also states that discussion should be had on optimal coding technology, the band compression technology, and switching functions.

CSO: 4120/103

SCIENCE AND TECHNOLOGY

USSR-JAPAN IMPORT, EXPORT DEAL UPDATED

Butadiene Plant

Tokyo NIHON KEIZAI SHIMBUN in Japanese 7 Oct 81 p 7

[Text] Toyo Engineering (TEC) and Mitsui & Co., Ltd. disclosed on the 6th that they have succeeded in obtaining from the Soviet Union's All Soviet Technical Machine Import Corporation (TECHMACHINEPORT) an order for a butadiene plant. The amount of the order is 25 billion yen. The Export-Import Bank of Japan has approved financing in the form of a bank loan (interbank loan). This is the first commitment for the export of a large scale plant to the Soviet Union since the imposition by the Japanese Government of economic sanctions against the Soviet Union that accompanied the invasion of Afghanistan. This commitment indicates the relaxing of sanctions against the Soviet Union; those in the plant industry are hoping that this will put the export of plants back on track.

This butadiene plant is to be included in the petrochemical complex that the Soviet Union's Oil Refineries and Petrochemical Industries Corporation has under construction in the western Siberia region. The plant's annual production capacity is 180,000 tons (two machines producing 90,000 tons each). The plant will produce synthetic rubber, using butane that is produced in the Tobolsk region of western Siberia. The plant is scheduled for completion in 1986.

This deal includes as a premise the use of the manufacturing process called the catadyne (?) process," which is owned by the U.S. Foodley [phonetic] Company, and for a time it was feared that the deal would not be made because of the need for U.S. Government approval. However, since there are precedents for exporting this process to the Soviet Union, the tacit approval of the U.S. was recently obtained. Since the Soviet Union indicated its final specifications this summer, intense competition for the order has ensured among four groups of Western European and Japanese companies: TEC and Mitsui, Italy's Eurotechnica, France's ProCon, Mitsubishi Heavy Industries and Nissho-Iwai as participants. Particularly after the Export-Import Bank of Japan financing firmed up in the latter half of September, the Japanese corporate powers, gained in strength and completed with each other in the final race. With respect to its success in obtaining the order, TEC interpreted that it was because the Soviet Union highly evaluated TEC's fertilizer plant exports to the Soviet Union. It has been 11 years since TEC exported a petrochemical plant to the Soviet Union, TEC exported a large scale ethylene plant in 1970.

Japan's export of plants to the Soviet Union has conspicuously decreased since the electromagnetic steel plating plant deal (approximately 80 billion yen) by the Nippon Steel Corporation in combination with Amco (U.S.) failed in the beginning of 1980 due to the impact of sanctions against the Soviet Union. In fiscal year 1980, there were only two or three small scale exports for less than 1 billion yen per item. The Export-Import Bank of Japan made a large scale loan to the Siberia Forest Development Project as a special case, and that was the only case. Recently, however, the Bank has begin to move at last to approve natural gas development and other projects.

Steel Plate for Large-Diameter Pipe

Tokyo NIKKAN KOGYO SHIMBUN in Japanese 27 Oct 81 p 6

[Text] Steel plate exports to the USSR have shown a trend toward rapid increases. At this summer's business talks, which encompassed negotiations on large diameter steel pipe, it was initially agreed that exports of steel plate to the Soviet Union will be 300,000 tons, to be delivered in shipments over the period between October of this year and July of next year. Subsequently, there was an additional order for 60,000 tons, and recently there has been another increase in the quantity requested. Ultimately the total amount has reached 400,000 tons, that is, 40,000 tons per month. All of this steel plate is a highly specialized manufactured product used for the large diameter steel pipe. Since the Soviet Union has increased production capacity of its pipe manufacturing facilities, there is a strong possibility of further increases in the volume of exports. For this reason, various steel companies are planning to send missions consisting of technicians to the Soviet Union as early as November, to discuss technical problems in pipe manufacturing and other subjects. They hope that through this process, they will gain a feeling for future trends in exports of heavy sheet metal to the Soviet Union. Thus, they are carefully observing the attitudes of the Soviet Union.

Following the conclusion of the large'diameter pipe exports negotiations, five companies--Nippon Corporation, Nihon Kokan K.K., Kawasaki Steel Corporation, Sumitomo Metal Industries, Ltd., and Kobe Steel, Ltd.--have made the steel plate deal and started exporting to the Soviet Union. Initially, the Soviet Union purchased only large diameter steel pipe. However, since transportation costs by sea from Japan are lower when steel plate is combined with the large-diameter steel pipe, the Soviet Union Began making periodic purchases of steel plate 2 or 3 years ago.

In contrast to large diameter steel pipe which is plant-related, steel plate is not eligible for Export-Import Bank of Japan financing, so a trading firm is providing financing for this deal. Their plan is to proceed with the large diameter steel pipe first. When those negotiations are concluded, they will begin negotiations on steel plate, using as a reference the negotiated price of large diameter steel pipe.

Initially, export volume of steel plate was less than 200,000 tons, or about the level of 15,000 tons per month. However, last year volume increased to 300,000 tons with the additional orders. In addition, the volume of the shipments from October of this year through July of next year, increased to 400,000 tons, 40,000 tons per month, reaching an annual rate of 500,000 tons.

The Soviet Union does not particularly explain the reason for this increase, but steel industry sources say that the Soviet Union's large diameter steel pipe production capacity has increased because it improved productions systems. Since pipe transportation costs are extremely high because it is bulky, it is natural for the Soviet Union to try to raise domestic pipe production capacity. Since steel plate is a highly specialized product, it is unthinkable to increase purchases if there were not any room for it in production capacity. However, the circumstances of the Soviet Union's increased orders are not known in detail.

Since exports of steel plate have increased, each company intends to send technicians on missions to the Soviet Union, and the Soviet Union is fundamentally in agreement. Negotiations on timing, etc, are underway. The technicians are planning to depart in the latter half of next month, and to exchange ideas on the technical problems of pipe manufacturing and on other topics with the All-Soviet Union Minerals and Industrial Products Export-Import Corporation, while they are going to observe pipe manufacturing plants. It is expected that at that time the Soviet Union's purchasing policies will become clear.

Horizontal Boring Machine

Tokyo NIKKEI SANGYO SHIMBUN in Japanese 7 Nov 81

[Text] The foremost maker of boring machinery, Tone Boring (Main Office Tokyo, President Mr Tatsuyoshi Numata, capital 230,000,000 yen) has received orders for sixteen horizontal boring machines from the Soviet Union's Transportation Construction Corporation (MINTRANSTROI). The full amount of the order is approximately 2,100,000,000 yen, a large scale order for machinery of this type. Shipments will begin this month by sea. The company's boring machinery is suitable for excavations in so-called "bad" strata (where it is extremely difficult to do excavations). In addition to the machinery for the Soviet Union, the Company has been approached with deals from West Germany and other places. Because the Company is attracting international attention, it appears that export negotiations will continue to the future.

The machinery to be exported to the Soviet Union is used in preliminary boring done in order to survey the strata at a drilling site. The Company developed the machinery for use in construction of the Seikan tunnel (from Aomori to Hakodate) using a shield drilling method with two heavy pipes. The interior pipe for use in excavation is wrapped in an exterior protective pipe, and has the capability of drilling into the broken ground and of withstanding pressure in the so-called "bad" strata. The machinery is said to have made the world record for the longest horizontal boring of 2,150 meters in the construction of the Aomori-Hakodate tunnel.

MINTRANSTROI, which oversees all railroad construction in the entire Soviet Union, has ordered from Tone Boring this time as a result of repeated technical investigations by delegations visiting Japan. The machinery will be used in mountainous sections of the Second Siberian Railroad (Baikal-Amur). The Soviet Union's export-import contract "window" is the Soviet Union Government Metallurgy and Mining Machinery Export-Import Corporation, and payment conditions are quotations in dollars and payment in dollars. This deal has absolutely no tie to inter-government

based financing or loans. It is said that payments will be made in full with the MINTRANSTROI's own fund.

Sakhalin Crude Oil

Tokyo NIKKAN KOGYO SHIMBUN in Japanese 10 Nov 1981

[Text] Asia Petroleum (President Mr Kotaro Hasegawa) is increasing imports of crude oil from the Soviet Union. Asia Petroleum has been importing Sakhalin light crude and Efabi crude oil under contracts for direct deals (DD) for nearly 10 years with the Soviet Union's Petroleum Export Corporation. This year also, Asia Petroleum imported 10,000 tons (daily volume approximately 1,900 barrels) doubling last year's imports. From the standpoint of shipping costs, geographical proximity makes Sakhalin crude oil more profitable than middle eastern crude oil. In addition, since the price is almost equal to the price of Saudi Arabian light crude oil, petroleum products made from refined Sakhalin crude oil are extremely competitive. Thus, Asia Petroleum has set a policy of increasing the volume of imports from the Soviet Union to the fullest extent possible next year and thereafter. Because the Soviet Union is the largest oil producing country in the world, and is continuously discovering and developing new oil fields located in Siberia, it has an appeal for Japan as a future source of crude oil supplies. There may be a movement in the industry to follow in the wake of Asia Petroleum.

Asia Petroleum has been in fortunate circumstance in terms of crude oil acquisition. Although Asia Petroleum is a purely Japanese company, it has a special non-aligned supply contract (third party) with Mobil's international petroleum capital (major). For example, in fiscal 1980, Asia Petroleum's imports of discounted Saudi crude oil reached 54 percent of its total compared to Japan's overall discounted Saudi crude oil imports on the level of 30 percent of its total, and the import price (CIF) per barrel of Asia petroleum was also on the average $32.37 while the CIF of the other oil companies with pure domestic capital was $33.53.

However, this year Asia Petroleum withdrew from the Kyodo Petroleum Group and formed a new group with Daikyo Oil Company, Limited, and since that time circumstances have changed. At the October special meeting of OPEC, a standard uniform price was reinstituted, and the price of Arabian light was raised by $2.00 per barrel. Thus, the price differnetial between Aramco and non-Aramco crude oil procurement costs is expected to disappear. However, it is still a clear advantage for all of the oil companies to maintain a high ratio of Saudi crude imports, in terms of price and stability of supply.

However, Daikyo Oil Company, Limited's Saudi crude oil ratio is only about 10 percent, the lowest even among the native Japanese oil companies. Moreover, it tends to be leaning toward the United Arab Emirates (UAE) and Kuwait. In order to advance cooperative business in such broad areas as refining and crude oil supplies, Asia Petroleum, which formed the new group, made the judgment that there is a need to assist in the improvement of Daikyo's crude oil acquisition situation. The increase in imports from the Soviet Union can also be seen as one indication of its efforts.

The purchase of Sakhalin produced crude oil was already initiated in the latter half of the mid 1960s, and heretofore 50,000 tons were imported annually on the condition that shipment be made between June and October when tankers can enter the port. This year Company President Hasegawa went to Moscow and negotiated with the head of the Petroleum Export Corporation. As a result, the Hasegawa doubles the volume of imports. In addition, both parties have agreed to study future increases.

Efabi crude has an API rating of 33-34, as light as ordinary Arabian light. Also, the price is geared to that of Arabian light. In addition, shipping costs are inexpensive because of Sakhalin's geographical proximity. Since these and other advantages are numerous, current thinking holds that the new group wants to develop the Sakhalin deal as a future supply source.

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SCIENCE AND TECHNOLOGY

USE OF OPTIC FIBER IN TELECOMMUNICATION NETWORK UNDER STUDY

Tokyo NIKKEI ELECTRONICS in Japanese 9 Nov 81 pp 245-252

[Text] Abstract: The Telegraph and Telephone Public Corporation (TTPC) has begun investigation of the technical feasibility of introducing optic fiber to the subscriber system. It is conceivable that in the future, in addition to nontelephone services such as data, facsimile and captain, the subscriber system will be able to have other services such as ultra-high-speed data, ultra-high-speed facsimile, ITV, TV conference, image information, TV lecture, and TV telephone. Technological preparations have been started to meet these challenges. The first onsite experiment has been completed in the Yokosuka area in Kanagawa Prefecture. Moreover, as a link in the drive to popularize the information network system, a model experiment is soon to be carried out in the Musashino and Mitaka areas of the city of Tokyo. This experiment will be centered around digital communications technology, but optic fiber is expected to be involved also.

Investigation into the application of optic fiber communication to the subscriber line has begun. The Yokosuka Electric Communications Research Center of the TTPC has already completed the first onsite experiment. On the other hand, under the powerful leadership of Vice President Yasusada Kitahara, investigation of the information network system (INS) has also begun. A model experiment using optic fiber scheduled to begin in 1983 is to be carried out in the Musashino and Mitaka areas of the city of Tokyo. For this project and the construction cost of the fourth electric communications research center which is under consideration, the TTPC has decided to increase its 1982 investigation and research expenditures by 12 percent over the previous year, to 90 billion yen (approximate figure requested). This amounts to approximately 2.2 percent of the business income, exceeding the 2-percent level which is considered a standard for investigation and research expenditure.

Figure 1 shows those services that are expected to be introduced to the subscriber system in the future.[1] There are a number of nontelephone services having an information volume comparable to that of telephone service, such as data, facsimile, and captain. Moreover, broad band services in the range of 1-4 MHz such as ultra-high-speed data, ultra-high-speed facsimile, ITV [industrial TV], TV conference,

image information, TV lecture and TV telephone, or high grade TV service in the range of 3 MHz may also be contemplated.

Introduction of optic fiber has special significance for the economics of broad band transmission routes.[2] Furthermore, flexibility and expansibility are necessary in order to be able to cope with the movement of new services. For this purpose, investigation of wavelength-splitting multiplex bilateral transmission[3] has been carried out. It is highly desirable that the subscriber system be of a nonrelay type from the viewpoint of economy and maintainability. At present, the nationwide average distance of the subscriber lines is 2 km, with 95 percent of the lines less than 5 km in length. When nonrelay transmission distance can be extended to 5-7 km through the use of optic fiber, almost all subscribers will be able to be connected without relay.

An outline of the experiments carried out in the Yokosuka area is summarized in Table 1. The trial system can be divided roughly into four groups. The primary group transmission system is one in which the application of PBX multiplex office lines and high-speed data to the subscriber line is investigated. The broad band subscriber system is suitable for big subscribers such as business offices containing PBX multiplex office lines, ultra-high-speed facsimile, ultra-high-speed data, and TV conference. The general subscriber system is aimed at the household application of 4 MHz TV in addition to providing services of the digital primary including facsimile, captain and data. The CATV system was introduced to ascertain the basic technology related to multiplex transmission of VHF band TV and high-grade TV transmission. The longest experiment section is 8.5 km long with a turn, and the shortest is 1.2 km. The experiment sections consist of various types of subsections, including pipe line section, overhead section and tunnel section.[4]

Multiplexing is accomplished by means of wavelength splitting using two waves in the primary group transmission system as shown in Figure 2(a); four waves in the broad band subscriber system as shown in Figure 2(b); five waves (with one wave for either high grade TV or UHF TV) for the general subscriber system as shown in Figure 3(a); and two waves in the CATV system[5] as shown in Figure 3(b).

Taking into consideration the initial deviation, thermal variation, and changes due to aging of the elements, the wavelength intervals chosen were 30 nm (semiconductor laser) for the short wavelength band and 150 nm (light emitting diode) for the long wavelength band. Three types of wave mixers and separators were prepared in accordance with the number of multiplexing. The insertion loss was 3.5-4.3 dB for the two wavelengths multiplexing (interference film filter). It was less than 10 dB for the four wavelengths multiplexing (concave diffraction grid), and it was less than 11.7 dB for the five wavelengths multiplexing (a combination between interference film filter and plain diffraction grid).

When direct analog modulation format involving semiconductor laser was used, the interference between the propagation modes was found to take place within the fiber due to the nature of laser, and speckle noise (modal noise) was generated. As a result, deterioration of the wave form and a reduction in S/N were experienced. The high frequency superposed modulation method[6] was used as the main measure for solving this problem. The optical feedback method[7,8] was also experimented with in the high grade TV transmission.

The station equipment was all accommodated in subracks. Equipment for the general subscriber system and the broad band subscriber system was packed two subscribers per subrack. The CATV system was packed with four high grade TV systems or four VHF TV systems per subrack, while the primary group transmission system was packed with an active system and a standby system per subrack. Each rack contained three subracks (four subracks in case of the primary group transmission system).

Taking into consideration its application in the subscriber system, a new type of optical connector consisting of an all-ceramic plug core was developed with a view to economy and simplicity.[9] The average connection loss (of 180 terminals) assembled onsite was found to be 0.74 dB, with a standard deviation of 0.16 dB.[10]

Table 2 summarizes the major experimental results obtained from the tests carried out on the optic fiber transmission system. The minimum light reception power of the 7 km analog channel was -36 dBm when the S/N was 42 dB. The differential gain was 4.1 percent for the 860 nm band and 3.5 percent (the standard is less than 5 percent) for the 890 nm band. The differential phases were, respectively, 2.4 degrees and 1 degree (ditto, less than 3 degrees); the frame slopes were, respectively, less than $\pm$ 2 percent and less than $\pm$ 2 percent (ditto, less than 10 percent); and the line slopes were, respectively, less than $\pm$ 1 percent and less than $\pm$ 1 percent (ditto, less than 5 percent). The standard for the image transmission was also satisfied, and no significant deterioration in the image quality was detected even after it was transmitted by an overhead cable over a distance of 5.6 km.

The average light reception power corresponding to a signal error rate of 10^{-9} was found to be -45 dBm in the case of digital transmission. It was found through this experiment that the actual loss due to optic fiber was less than the design standard. Therefore, nonrelay transmission over a distance of 7 km could be accomplished even when system margins of 2 dB for the analog channel and 3 dB for the digital channel were used. The themes for future study should include practical application of the power supply method, supervisory control method using optical transmission line, and testing method for the wavelength multiplexing system. Apart from the general household applications, the broad band services for the big subscribers such as business offices can be expected to be realized fairly soon.

The INS model experiment will be carried out in 1982 in the Musashino and Mitaka areas of the city of Tokyo.

The INS idea concerns digitization of the conventional analog telephone network (including digitalization of subscriber lines) and then utilizing this digital network for various services.[11] In addition, the transmission charge for all services is said to be computed on the basis of the bit number (quantity of information) (a charging format based on the quantity of information). In this way there will be no contradictions as far as charges are concerned even if different types of services are intermixed. For example, the telephone service charge will be computed on the basis of 64 kbits/second multiplied by the duration of conversation. Telephone services using a compressed band of 32 kbits/second can also be contemplated.

The TTPC has firmly drawn up a plan to carry out a series of model experiments in the Musashino and Mitaka areas of the city of Tokyo starting in 1982. Approximately 10,000 general subscriber telephones, approximately 250 digital telephone terminals and approximately 750 nontelephone terminals will be installed free of charge in homes and offices in the designated area in order to carry out the experiments. Figure 4 shows the block diagram of this model system.

The services that will be provided include: 1) those services in which the digital effects are most significant (such as digital facsimile, digital still picture, compound PBX, document communication and processing, and multimedia services); 2) those services introduced mainly for the purpose of confirming the technological feasibility of digitization (such as digital telephone and digital scanned image communication service); 3) those services introduced for the purpose of confirming the effectiveness of optic fiber utilization (such as ultra-high-speed facsimile and image circuit service); and 4) those services introduced mainly for the purpose of confirming the technology related to the unification of the digital networks (such as digital data exchange and facsimile communications network).

However, matters related to budgeting are not yet quite settled. The estimated request for the 1982 budget includes 90 billion yen for investigation and research expenditures, which amounts to an increase of 12 percent over the previous year. This significant increase in the budget is considered to be due in part to a desire to realize the INS idea. However, on the other hand, President Tsune Shindo declared that he would apply a brake to the annual 1.7 trillion equipment investment (construction investment) at present because of uneasiness over a trend of declining business income. It appears, therefore, that some operational adjustment will have to be made even on such items as investment in new business activities.

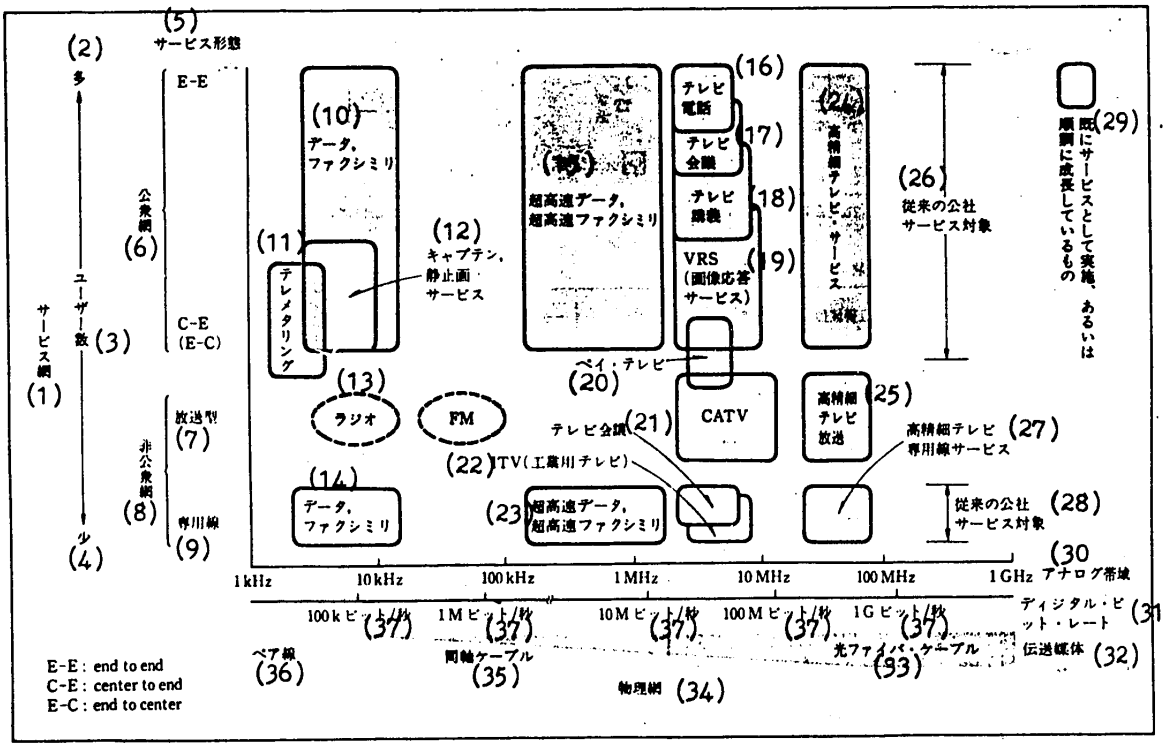

図1 将来，加入者系へ導入が予想されるサービス[1]

Figure 1. Services expected to be introduced to the subscriber system in the future.[1]

Key: (1) Service network (2) More (3) User number (4) Less (5) Service format (6) Public network (7) Broadcast type (8) Nonpublic network (9) Special line (10) Data, facsimile (11) Telemetering (12) Captain, still image service (13) Radio (14) Data, facsimile (15) Ultra-high-speed data, ultra-high-speed facsimile (16) TV telephone (17) TV conference (18) TV lecture (19) VSR (video response service) (20) Pay TV (21) TV conference (22) ITV (industrial TV) (23) Ultra-high-speed data, ultra-high-speed facsimile (24) High grade TV service (25) High grade TV broadcast (26) Objects of the public corporation's conventional services (27) High grade TV special line service (28)=(26) (29) Those services already implemented or growing smoothly (30) Analog band (31) Digital bit rate (32) Transmission medium (33) Optic fiber cable (34) Physical network (35) Coaxial cable (36) Pair line

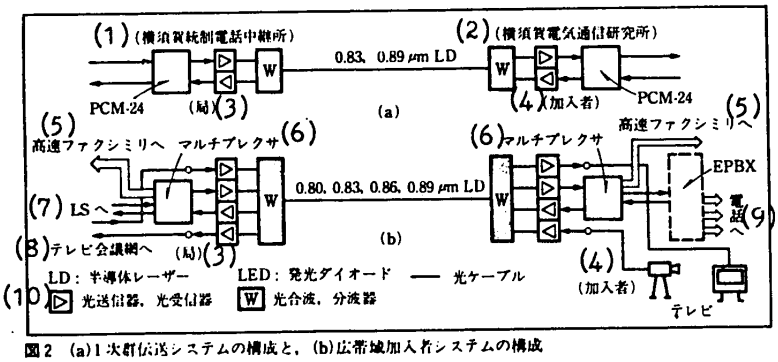

図2 (a)1次群伝送システムの構成と, (b)広帯域加入者システムの構成

Figure 2. (a) Construction of primary group transmission system.
(b) Construction of broad band subscriber system.

Key: (1) Yokosuka controlled telephone relay station (2) Yokosuka Electric Communications Research Center (3) Station (4) Subscriber (5) High-speed facsimile (6) Multiplexer (7) To LS (8) To TV conference network (9) To telephone (10) LD: Semiconductor laser, LED: Light emitting diode, ——: Optic cable, ▷: Optic transmitter, optic receiver, W: Optic mixer, optic separator

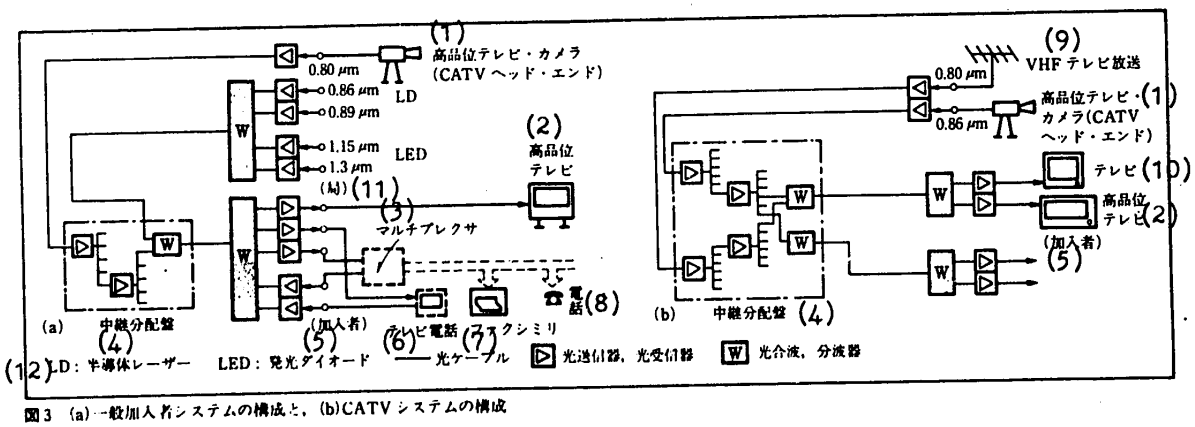

図3 (a)一般加入者システムの構成と, (b)CATV システムの構成

Figure 3. (a) Construction of general subscriber system.
(b) Construction of CATV system.

Key: (1) High grade TV camera (CATV headend) (2) High grade TV (3) Multiplexer (4) Relay distributer board (5) Subscriber (6) TV telephone (7) Facsimile (8) Telephone (9) VHF TV broadcast (10) TV (11) Station (12) LD: Semiconductor laser, LED: Light emitting diode, ——: Optic cable, ▷: Optic transmitter, optic receiver, W: Optic mixer, optic separator

Table 1. Outline of optic fiber transmission experimental system in Yokosuka area.

表1 横須賀地区での光ファイバ伝送実験システムの概要

	1次群 (A) 伝送システム	(B) 広帯域加入者システム				(C) 一般加入者システム				(D) CATVシステム	
(1) 伝送信号	ディジタル 1次群	(E) ディジタル 2次群		(F) カラー・テレビ信号…1ch 音声信号……1ch		(G) ディジタル 1次群		(H) カラー・テレビ信号…1ch 音声信号……1ch		(I) 高品位カラー・テレビ信号	(J) VHF帯 カラー・テレビ信号
(2) 適用距離(目標値)	12km	7km				5km				5km	2km
適用光ケーブル(3)	グレーデッド・インデックス型マルチモード光ファイバ										
(4) 伝送路符号(信号)	CMI	CMI		アナログ・ベース・バンド		CMI		アナログ・ベース・バンド		アナログ・ベース・バンド	アナログ直接輝度変調 (IM)
光源 (5)	GaAlAs LD	GaAlAs LD				GaAlAs LD	InGaAsP LED	GaAlAs LD	InGaAsP LED	GaAlAs LD	
波長(μm)(6)	下り 0.83 / 上り 0.89	下り 0.80	上り 0.83	下り 0.86	上り 0.89	下り 0.89	上り 1.15	下り 0.86	上り 1.3	0.86(0.80)	0.80
受光素子 (7)	Si APD	Si pin PD		Si APD		Si APD	Ge APD	Si APD	Ge APD	Si APD	
サービス例 (8)	PBX 超高速データ	PBX 超高速ファクシミリ 超高速データ		4MHzテレビ (テレビ会議用)		ファクシミリ キャプテン データ		4MHzテレビ (映像情報サービス用)		高品位テレビ	VHFテレビ放送

注) LD: 半導体レーザー LED: 発光ダイオード APD: なだれフォトダイオード
(9) PD: pin型フォトダイオード CMI: Coded Mark Inversion

Key: (A) Primary group transmission group (B) Broad band subscriber system (C) General subscriber system (D) CATV system (1) Transmitted signal (2) Applicable distance (target value) (3) Applicable optic cable (4) Transmitted code (signal) (5) Light source (6) Wavelength (μm) (7) Light receiving element (8) Example of service (9) Note: LD: Semiconductor laser, LED: Light emitting diode, APD: Avalanche photodiode PD: pin-type photodiode (A1) Digital primary group (A3) Graded index type multimode optic fiber (A6) Down 0.83, Up 0.89 (A8) PBX, ultra-high-speed data (E1) Digital secondary group (E3)=(A3) (E6) Down 0.8, Up 0.83 (E8) PBX, ultra-high-speed facsimile, ultra-high-speed data (F1) Color TV signal...1 ch, Audio signal...1 ch (F3)=(A3) (F4) Analog base band (F6) Down 0.86, Up 0.89 (F8) 4 MHz TV (TV conference) (G1) Digital primary group (G3)=(A3) (G6) Down 0.89, Up 1.15 (G8) Facsimile, Captain, Data (H1) Color TV signal...1 ch, Audio signal...1 ch (H3)=(A3) (H4) Analog base band (H6) Down 0.86, Up 1.3 (H8) 4 MHz TV (image information service) (I1) High grade color TV signal (I3)=(A3) (I4) Analog base band (I8) High grade TV (J1) VHF band color TV signal (J4) Analog direct brightness modulation (IM) (J8) VHF TV broadcast

Table 2. Major test results of trial facilities for optical transmission system.

表2 試作装置の光伝送系主要実験結果

(A)	チャネル	1	2	3	4
(B)	伝送信号	6.3Mビット/秒(下り)	6.3Mビット/秒(上り)	4MHzカラーテレビ(下り)	4MHzカラーテレビ(上り)
(C)	変調形式	PCM-IM		直接IM	
(D)	光源	GaAlAs半導体レーザー			
(E)	中心波長	789nm	829nm	861nm	888nm
(F)	ファイバ内光出力	−3.6dBm	−3.5dBm	−7.3dBm	−7.1dBm
(G)	受光素子	Si pin型フォトダイオード		Siなだれフォトダイオード	
(H)	最小受光電力注)	−46.8dBm	−45.6dBm	−38.5dBm	−37.6dBm
(I)	合波分波損失(含むバンド・パス・フィルタ)	12dB (5.5 / 6.5)	10.7dB (5.2 / 5.5)	10.6dB (5.6 / 5.0)	11.6dB (5.9 / 5.7)
(J)	コネクタ損失	1dB			
(K)	許容線路損失	30.2dB	30.4dB	19.6dB	17.9dB
(L)	光ケーブル損失(含むスプライス)	3.1dB/km	2.6dB/km	2.5dB/km	2.2dB/km
(M)	マージン	8.5dB	12.2dB	2.1dB	2.5dB
(N)	無中継伝送距離	7km			

(O) 注) ディジタル・チャネルは誤り率10^{-9}
アナログ・チャネルは S/N 42dB

Key: (A) Channel (B) Transmitted signal (C) Modulation format (D) Light source (E) Central wavelength (F) Light output power inside fiber (G) Light receiving element (H) Minimum light reception power (see note) (I) Mixing/separation loss (including bandpass filter) (J) Connector loss (K) Allowable line loss (L) Optic cable loss (including splice) (M) Margin (N) Nonrelay transmission distance (O) Note: Digital channel error rate 10^{-9}, Analog channel S/N = 42 dB (1B) 6.3M bit/sec (down) (1D) GaAlAs semiconductor laser (1G) Si pin-type photodiode (2B) 6.3M bit/sec (up) (2D)=(1D) (2G)=(1G) (3B) 4 MHz color TV (down) (3C) Direct IM (3G) Avalanche photodiode (4B) 4 MHz color TV (up) (4C)=(3C) (4G)=(3G)

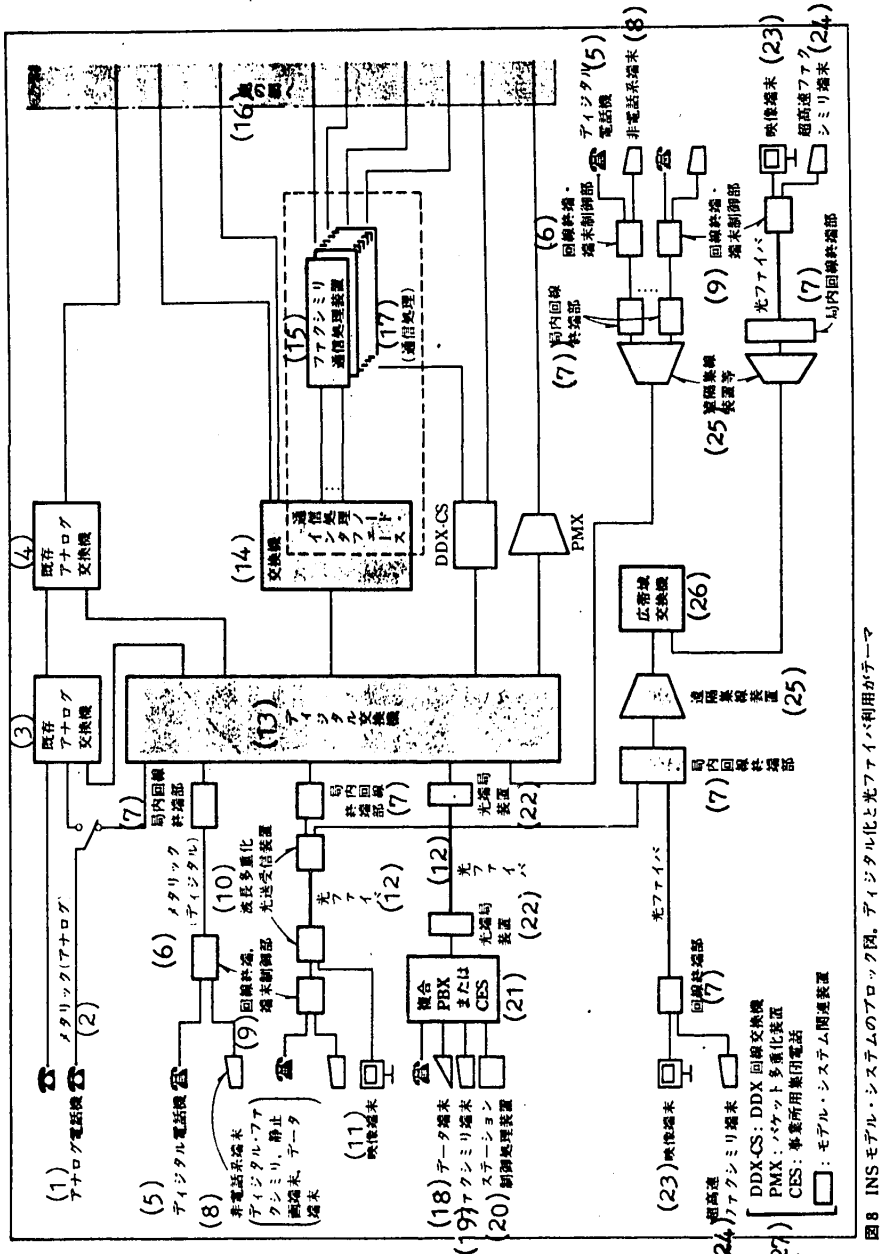

図8 INSモデル・システムのブロック図、ディジタル化と光ファイバ利用がテーマ

Figure 4. Block diagram of INS model system--digitalization and optic fiber application the main theme.

[Key on following page]

Key: (1) Analog telephone (2) Metallic (analog) (3) Existing analog exchange (4)=(3) (5) Digital telephone (6) Metallic (digital) (7) Circuit terminal at station (8) Nontelephone terminals (digital facsimile, still image terminals, data terminal) (9) Circuit terminal, terminal control (10) Wavelength multiplexing optic transceiver equipment (11) Image terminal (12) Optic fiber (13) Digital exchange (14) Exchange, communication processing mode interface (15) Facsimile communication processing equipment (16) To other network (17) Communication processing (18) Data terminal (19) Facsimile terminal (20) Station-controlled processing equipment (21) Compound PBX or CES (22) Optic terminal station equipment (23) Image terminal (24) Ultra-high-speed facsimile terminal (25) Remote junction equipment (26) Broad band exchange (27) DDX-CS: DDX circuit exchange, PMX: Packet multiplex equipment, CES: Group telephone for business offices, [ ]: Equipment related to the model system

FOOTNOTES

1. Asaya, Nosu, Matsumoto: "Construction and Characteristics of Optic Subscriber System in Yokosuka Area," Technical Report (Communication Format) of Electronic Communications Society, CS81-62, July 1981.

2. Nikei, Yamaguchi, Kajima, Hatano: "Construction and Characteristics of Optic Subscriber Experimental line," ibid, CS81-63, July 1981.

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SCIENCE AND TECHNOLOGY

HITACHI TO MASS PRODUCE 256K RAM CHIPS IN FALL

Tokyo JAPAN ECONOMIC JOURNAL in English Vol 19 No 987, 22 Dec 81 p 1

[Article by Ryuichi Kato]

[Text]

Hitachi, Ltd. disclosed last week that it will begin mass production of 256-kilobit random access memory (RAM) chips in the autumn of next year, ahead of all other semiconductor manufacturers in the world.

The 256K, which actually has 262,144 memory cells on a tiny silicon substrate several millimeters square, is four times as large in memory capacity as the preceding 64K, of which mass production started only recently.

Leading Japanese and American semiconductor makers have been fiercely racing to commercialize the very large-scale integrated circuit (VLSI). Hitachi has emerged from the experimental stage and entered the practical production stage, outpacing its arch rivals — Nippon Electric Co. (NEC) and Fujitsu Limited.

The 256K is expected to accelerate the so-called "microelectronics revolution" now under way. The tiny silicon chip will make it possible to produce a TV-size high-speed computer, a multi-function industrial robot and many other innovational industrial and household products.

Hitachi's achievement is expected to have a delicate impact on the intensifying rivalry between Japan and the U.S. over high-technology development.

Hitachi, the world's fourth largest semiconductor maker, plans to start sample shipments of the 256K next autumn to more than 100 large-lot customers in Japan and abroad for their individual efficiency tests of the sample products. Upon completion of these tests, these possible customers are expected to issue purchase orders in the spring of 1983. From around this time, Hitachi plans to start mass production at a monthly scale of several tens of thousands units. It hopes to boost the monthly output volume to 100,000 chips by early 1984.

Mass production of the 256K will be made at its Musashi Works located in Kodaira, western Tokyo. Hitachi seems to have already started construction of topflight production lines within the Musashi Works.

Hitachi's move has disproved the view commonly shared within the industry that the 256K would become popular in 1985. The company's strategy to manufacture and market the 256K well in advance of the predicted date is apparently aimed at grabbing a big market share at a stroke before the entry of rival makers.

With Hitachi's announcement, it now seems certain that other Japanese, American and European semiconductor makers will rush into the 256K market sooner or later. In particular, U.S. makers who are fighting a losing battle in the 64K market are expected to carry out massive rollback attempts against Japanese makers. Some of them may step up criticism against increasing imports of Japanese-made VLSIs, and some may try to introduce Japan's superior VLSI mass-production techniques to survive. Also, moves to locate production plants in Japan will become more conspicuous.

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SCIENCE AND TECHNOLOGY

TOSHIBA MACHINE DEVISES AUTOMATIC PLASTIC INJECTION MOLDING SYSTEM

Tokyo JAPAN ECONOMIC JOURNAL in English Vol 19, No 986, 22 Dec 81 p 7

[Text] A computerized control system to automatically operate numerous plastic injection molders simultaneously with the so-called flexible manufacturing system (FMS) or to undertake many variety-small quantity production has been developed by Toshiba Machine Co.

The leading Tokyo machine tool maker says it is already technologically sure of producing a full-fledged commercial prototype of the system with a capacity to simultaneously handle 30 plastic molders at the maximum. Up to a total of 32 different varieties of plastic material is usable with so many molders.

Tradenamed Injectivisor-350, the new system features a central computer that works just like human being in exchanging molders and setting appropriate molding conditions according to changing needs, checking and controlling the whole progress of plant operations, and even in controlling product qualities and raw material supplies.

The automation also is said to ensure perfect quality uniformity and high precision of the products.

Such an FMS type plastic goods production automation system is just what is needed for Japan's many plastic molding factories whose round-the-clock operation is now almost common sense.

Development of the system was prompted by the following reasons:

—The use of plastic parts has been rapidly mounting among many Japanese industries, including electric-electronic, acoustic, camera and office equipment manufacturers, but due to frequent remodelling and technological improvements, there has been also an increasing trend toward the FMS type of such plastic manufacturing.

—Demand for precision of such injection-molded plastic goods down to the micron level has been also growing, arousing natural demand for complete plant automation and high production yields.

As for injection plastic molding plants suited for automation, Nissei Plastic Industrial Co. of Sakaki, Nagano Prefecture, has recently come up with its Future System model, while Japan Steel Works, Ltd. and Sumitomo Heavy Industries, Ltd., both of Tokyo, are likely to follow up with their respective competitive products during next year.

CSO: 4120/100

SCIENCE AND TECHNOLOGY

JAPAN'S NISSAN FIRM TO PRODUCE DEFENSE EQUIPMENT

PM291327 London THE TIMES in English 29 Dec 81 p 7

[Peter Hazelburst dispatch: "Japanese Car Firm Goes Into Missile Business"]

[Text] Tokyo, 28 Dec--The Nissan Motor Company of Japan is to diversify its business and produce missiles, ammunition, rockets, cannon shells and other weapons.

The company, which has already been manufacturing 107mm trench mortar shells and 70mm rockets for the Japan Defence Agency, has drawn up plans to manufacture arms on a wider scale "in line with the government's policy of spending more on defence," Mr Mitsuya Goto, a spokesman for Nissan told THE TIMES.

"At present arms sales are small, and represent 0.04 percent of the total turnover of the company. We intend to expand our manufacturing facilities but only for equipment for the Defence Agency. Under the terms of the constitution we are prohibited from exporting arms," Mr Goto said.

Under the constitution laid down by the American occupation forces three decades ago, Japan is prohibited from exporting arms or building up "a defence force in terms of an offensive power."

The Nissan Motor Company, which makes Datsun cars, is cooperating with arms manufacturers, such as Mitsubishi Heavy Industries and the Toshiba Corporation, in producing parts for rockets and weapons systems for the Defence Agency and the Space Development Corporation.

Nissan disclosed that it was manufacturing arms and completing subcontract work for the Defence Agency and Space Development Agency in a local plant in Ogikubo, Tokyo. It is already producing rockets for Japan's weather satellites, and multi-stage rockets. Nissan's total arms sales will amount only to 28 m pounds this year. A senior source said the company was no longer prepared to remain a sub-contractor and had prepared plans to build complete weapons and rockets systems. Company executives have already approached American arms manufacturers to obtain licenses to produce weapons and missiles in Japan. Nissan may soon be producing command and order systems for missiles, rockets, launchers, homing devices and explosive heads.

Mr Goto confirmed reports that Nissan also plans to cooperate with Hitachi, the Electronics Company and Fuji Heavy Industries in the defence field. He also confirmed rumours that the company had decided to establish a planning division within its space and aeronautics development department to develop an arms manufacturing strategy.

CSO: 4120/107

SCIENCE AND TECHNOLOGY

MITSUBISHI ELECTRIC RAISES 64K RAM OUTPUT TARGET

Tokyo JAPAN ECONOMIC JOURNAL in English Vol 19 No 987, 29 Dec 81 p 8

[Text]

Mitsubishi Electric Corp. has revised upward its production target of 64-kilobit random access memories (RAM) to 500,000 chips monthly as of the end of next March from 300,000 chips originally planned.

Brisk demand for the first-generation product of very large-scale integrated circuits (VLSI) has led the Tokyo company to accelerate its production expansion program.

As of next March-end, Mitsubishi will become Japan's fourth largest supplier of 64K RAMs, following Nippon Electric Co. (1.05 million chips), Hitachi, Ltd. (1 million) and Fujitsu Ltd. (600,000). It will outrank Toshiba Corp. and Oki Electric Industry Co., both of which plan to turn out 300,000 chips monthly as of the same date.

According to Mitsubishi, 64K sales have been rising sharply. Sales in the U.S., the world's biggest market, in the third quarter of 1981 reached 320,000 chips, 4.6 times larger than in the second quarter. Mitsubishi's 64K marketing share in the U.S. accordingly advanced to 9.2 per cent in the third quarter from 4 per cent in the preceding quarter. Among Japanese semiconductor makers, Mitsubishi was the third largest supplier of 64Ks to U.S. customers in the third quarter after Hitachi and Fujitsu.

Purchase orders for 64Ks continue brisk in the fourth quarter, Mitsubishi said. Also, the company has been actively mounting 64Ks on its computers and office automation equipment.

CSO: 4120/100

SCIENCE AND TECHNOLOGY

MIKUNI EYES EXPORTING ITS 'PAPIA' KNOW-HOW

Tokyo JAPAN ECONOMIC JOURNAL in English Vol 19 No 986, 22 Dec 81 p 9

[Text]

A new unique lightweight and strong automobile part material made from a mixture of old paper and plastic and producible at half or less than half the cost of ordinary plastic equivalents, developed by a leading Japanese auto parts maker, is proving a big hit, both domestically and internationally.

Mikuni Seisakusho Co., developer of the new material, says it has been receiving a rush of demand for the new product, tradenamed "Papia", since its development in 1979 from many big domestic and foreign automakers.

The Tokyo firm plans to license its production technology because such technology exports are more profitable than exports of the product itself.

Mikuni Seisakusho believes its Papia has attracted attention of the world's automobile makers as an ideal low-cost and lightweight part of new small fuel-efficient cars all such makers are racing to develop.

The new material is created by synthesizing polypropylene with some kind of waste paper or other, including printing matrix cuttings, old newspapers, magazines, and the like. It features a highly effective combination of the characteristics of plastic and paper, including lightness in weight and easiness to mold, and unbrittle strength. Papia is strong enough to make compressor and other machine covers as well as door linings and floor sheetings.

Compared with the conventional mainstay auto part plastic material, ABS (acrylonitrile-butadiene-styrene) resin, it costs no more than half to produce.

The company has signed a contract with Mitsubishi Corp. to empower the latter to handle all patent licensing and other international affairs concerning the new product, promising to pay a 10 per cent commission out of royalty revenue.

CSO: 4120/100

SCIENCE AND TECHNOLOGY

JAERI CREATES HEATER TO PRODUCE 100 MIL. °C

Tokyo JAPAN ECONOMIC JOURNAL in English Vol 19 No 986, 22 Dec 81 p 13

[Text]

A prototype of plasma heaters for Japan's Tokamak test facility has been completed by the semi-governmental Japan Atomic Energy Research Institute (JAERI).

It has opened the way for development of one of two types of fast breeder reactors. The institute hopes to attain the longest time for plasma heating.

The plasma heating device, believed to be the world's first of its sort to be built on a practical basis, was built at its Nakacho, Ibaraki Pref. experiment station site of its JT-60 Tokamak plasma criticality experimental plant.

The heat lasts only 0.1 second in heating beam-generating time, but the time will be steadily lengthened to at least 10 seconds, compared with 1.5 to 5 seconds with equivalent American, Soviet and European Atomic Energy Community (Euratom) experimental facilities of the Tokamak type still under development.

Every such facility is intended to attain the least necessary condition, or critical plasma requirement, to generate energy in the same amount as the energy used for causing atomic fusion for energy generation. At least 100 million degrees C. is required in the plasma momentarily pent up inside the doughnut-shaped tube of the facility — an immensely hot condition of rapidly flying atomic nuclei and electrons of hydrogen atoms.

The facility itself can attain only 20 million degrees C. in plasma temperature.

The plasma heaters to shoot high-speed neutron beams at the plasma are to help raise the temperature to 100 million degrees C. or higher.

CSO: 4120/100

SCIENCE AND TECHNOLOGY

GOVERNMENT INSTITUTE USES ION BEAM TO PRINT EXTREMELY MINUTE PATTERNS

Tokyo JAPAN ECONOMIC JOURNAL in English Vol 19 No 986, 22 Dec 81 p 13

[Text] A Japanese governmental electronic laboratory has successfully printed, by ion beam method, extremely fine semiconductor circuitry averaging 0.1 micron in line width. A similar success was achieved about two years before by Hughes Research Laboratories of Malibu, California.

The time lag does not necessarily mean that Japan is falling behind the U.S. in developing VLSI (very large-scale integration) semiconductor circuitry. The new government institute job, like the preceding American industrial one, is in the area of printing electronic circuitry by an internationally known new ion beam method. It is yet to be commercially developed to replace established optical and electron beam methods. The Japanese electronic industry and cooperating Nippon Telegraph and Telephone Public Corporation (NTT) are known to be as sophisticated as any foreign competitor in such technology. NTT is reported to be developing surprising VLSI circuit printing "explosion" and "chemical reaction" methods to do such jobs instantly.

All such efforts are to achieve the narrowest possible circuit line width at "submicron" level or less than 1 micron (1/1,000th of a millimeter) for miniaturizing future wonder computers and semiconductor devices.

The "submicron" circuit line width is two-digit percentages less than the conventional finest semiconductor line width level in general application.

According to the Electrotechnical Laboratory at Tsukuba, northeast of Tokyo, under the Ministry of International Trade & Industry's Agency of Industrial Science & Technology, its new method still requires refinement to reduce the long working time required. However, it features complete dispensation of the printing mask and potential as an effective commercial method.

The new ion beam exposure circuit line printing method features three kinds of electrodes. One of the electrodes is an "ion beam source," an assembly of needle-shaped structures containing different metals like gallium, gold and indium, all in liquid form. The needle-like structures are heated to different temperatures between 100 and 1,000 degrees C. to keep the metals melted and liquid during operation.

A second of the electrodes, a power source, is placed 17 millimeters away from the ion beam source. An electric pressure of 50 kilovolts is applied from the power source to the ion beam source, and various metal ions jump out of the ion source's working tip.

A third electrode to control the ions is placed near that tip. This "bias" electrode properly adjusts the discharge of the ions into a constant, uniform and stable beam. It also regulates the ion's electric current and acceleration of the voltage at work behind.

The beam is guided down onto the surface of silicon substrate. That surface is covered with a thin film of gold attached by vacuum vapor deposition. The printing means etching of the wanted lines by scraping off the metal film by beam energy.

The best results so far attained were the etching of 90 lines on a 40-square-micron substrate at intervals of 0.45 micron. The line width varied between 0.05 and 0.12 micron, an average of 0.1 micron. Printing one line needed 12 seconds and completing one circuitry on each substrate 18 minutes.

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SCIENCE AND TECHNOLOGY

ADDITION OF TITANIUM GREATLY INCREASES ELECTRO-MAGNETIC POWER

Tokyo JAPAN ECONOMIC JOURNAL in English Vol 19 No 986, 22 Dec 81 p 13

[Text]

A Japanese governmental laboratory has developed a super-conductive electromagnet useful in developing important energy supplies and nuclear science facilities. These might include nuclear fusion reactors, super-electric generators, electric power storage systems, and super-high energy nuclear particle accelerators.

The development of the titanium-added material—a niob-3-tin type—by the National Research Institute for Metals in Tokyo; of the Government's Science and Technology Agency, has apparently widened the way for creation of a new high-efficiency, compact-sized superconductive electromagnet essential for the development of prospective energy and nuclear particle engineering facilities.

According to the institute, an alloy of niob and titanium made in the form of a thin wire rod has so far been used to make superconductive electromagnet material for research and development purposes. But, the niob-3-tin type has recently been recognized as a better alloy for its capacity to create a strong stable magnetic field.

The niob-3-tin wire rod is a complex structure — a very thin, multiple-core type. It is principally a wire rod of bronze (an alloy of copper and tin) measuring a few millimeters across, wherein many core lines of niob are buried. Each niob line is as slender as 5 micrometers (5/1,000th of a millimeter) in diameter. When the whole wire rod is heated for 50 to 100 hours at a temperature of between 700 and 800 degrees C., the internal niob lines become covered with a thin film of niob-3-tin to make the niob-3-tin wire rod.

Finding that type still unsatisfactory the institute has tried to add titanium, hafnium, zirconium, and other metallic elements to that material. It has also developed two ways of doing so.

By one of the ways — replacing the niob lines of a niob-titanium alloy and adding 1 to 5 per cent titanium to the alloy, the institute has developed the new type of material with a slightly titanium-containing covering of such core lines.

The resultant wire rod has proved to attain 24 Tesla in the critical (maximum possible) magnetic field strength, 20 per cent higher than the conventional niob-3-tin type, and more surprisingly thousands of amperes per square centimeter in critical current density at 15 Tesla, 100 per cent higher. The other way to add a little titanium to the principal bronze material has proved about as successful, simpler and more commercially practical ("Tesla" is a unit of magnetic flux.)

CSO: 4120/100

SCIENCE AND TECHNOLOGY

'ASAHI' VIEWS JAPAN'S SPACE DEVELOPMENT PROGRAM

OW241803 Tokyo ASAHI EVENING NEWS in English 23 Dec 81 p 3

["Today's Science" column by Tetsuji Shibata, ASAHI SHIMBUN science editor: "Scientific Satellites"]

[Text] There are two main institutions promoting Japan's space development. The National Space Development Agency (NASDA) launches so-called "practical use" satellites for climatic, studies, broadcasting and other communication activities, while the Institute of Space and Astronautical Science (ISAS) oversees research on satellites for purely scientific research.

The NASDA failed to successfully launch an experimental stationary communication satellite in 1979 and 1980, but it successfully sent the meteorological satellite, the No 2 Himawari (Sunflower), into orbit this past summer. It was a big relief for the agency.

The ISAS is in a cheerful mood, having successfully launched on schedule all of its scientific satellites in recent years. In addition, the satellites are enabling the institute to make new discoveries one after another and to thereby become known internationally.

The ISAS was a part of Tokyo University before becoming independent in April this year. Its former name was Tokyo University's Space and Aeronautics Research Institute. Now the institute is under the jurisdiction of the Education Ministry and all national universities are entitled to use the institute's facilities. The scale of the institute had become too large to remain a part of a university and it was reorganized into the current form.

The first scientific satellite successfully launched in Japan was the Ohsumi, which was sent into orbit in February 1970. It was a small satellite weighing only 24 kilograms, but the first four attempts to launch it failed.

A series of successes followed, however, and sent into orbits as scheduled were: an experimental satellite Tansei, the first scientific satellite Shinsei, the second scientific satellite Dempa (electric wave) and the third satellite Taiyo (the sun).

Three scientific satellites are now in orbit. They are Jikeken (magnetic sphere), a satellite for observation of electron density launched in September 1979, an x-ray planet observation satellite Hakucho (swan) sent into orbit in February 1979 and Hinotori (fire bird) for observation of the sun launched in February 1981.

Among them, Hakucho is drawing the most attention. It senses x-rays which come from deep space and analyzes the rays. It is said that the sources of the cosmic x-rays are neutron stars--very heavy planets of ultra high density. Scientists now know of various x-ray starts, including pulsers that regularly emit x-rays and bursters that explosively emit x-rays from time to time.

It is very hard to capture faint x-ray that may come at any time and from any angle and to determine the source. Prof Minoru Oda of the ISAS overcame this difficulty by developing "bamboo screen collimator," even earlier than foreign scientists. A number of new bursters were found one after another.

The institute has also found a pattern of bursting for the first time in the world and collected many valuable data to lead the world's x-ray astronomy. It is fresh in our memory that the Asahi award was given to the Hakucho research group earlier this year.

The scientific satellite Jikiken is rounding the earth on an oval orbit with an apogee of 30,000 kilometers and a perigee of 200 kilometers. During the past three years the satellite collected many data on electron density and plasma waves around the earth.

The latest satellite Hinotori, which is also called Astro-A, is successfully observing in detail the sun's flare. The sun's activities are reaching their peak this year. The satellite features capability of catching and analyzing quickly the x-ray from the sun's flare that changes moment to moment. Many new discoveries are said to have been made.

The ISAS plans to launch Astro-B for observation of x-ray starts in 1983, Exos-C for observation around the earth in 1984, Planet-A for observation of the Halley's comet in 1985 and Astro-C for precision observation of x-ray planets in 1987. All of these satellites are planned to be launched with the three-stage M-3s rockets using solid fuel.

Many people abroad show keen interest in these Japanese scientific satellites and hope for further successes. In the United States and other countries the scale of scientific satellite programs is being cut down because of financial problems. Because of this and past successes, Japan's scientific satellites are beginning to be watched with interest.

Scientists of Britain and the U.S. have asked the ISAS to allow them to join the Astro-C project and the Japanese institute is studying the request. It is likely to approve the foreign researchers participation. Japan lags behind in many aspects of space development, but in the field of scientific satellites, the country may be among the world's most advanced.

CSO: 4120/107

SCIENCE AND TECHNOLOGY

NIPPON STEEL, MITSUBISHI CI TIE UP TO PRODUCE NEW MATERIALS

Tokyo JAPAN ECONOMIC JOURNAL in English Vol 19 No 987, 29 Dec 81 p 9

[Text]

Nippon Steel Corp. and Mitsubishi Chemical Industries, Ltd., the largest makers of steel and chemicals, have agreed to tie up for development of ceramics and other new materials. The agreement is for development by the two groups, including Nippon Steel Chemical Co. and Mitsubishi Light Metal Industries, Ltd.

The cooperation was planned at a time when steel, chemical and aluminum industries are threatened by competition with developing countries' industries and ceramic and material revolution is progressing.

The initial development efforts will center around ceramic and alumina fibers.

Nippon Steel will induct ceramic fiber technology from Manville Corp., Denver-based maker of inorganic materials.

Until the world's largest steelmaker starts production at its Sakai works in the spring of 1983, Manville products will be marketed in Japan by both the steel company's chemical subsidiary and Mitsubishi Chemical.

Mitsubishi Chemical and Mitsubishi Light Metal will try to develop alumina fibers with technical cooperation from the steelmaker. Production will be handled by the aluminum maker at Naoetsu, with the two chemical companies slated to market them.

Alumina fiber is a polycrystal fiber which can withstand high temperatures (about 1,600 degrees centigrade).

Yutaka Takeda, who was named NSC president in July, 1981, intends to foster chemicals as a major business after steel and engineering. To realize the goal, he chose the largest Japanese chemical company and its group as its partner.

On its part, Mitsubishi Light Metal suffers a problem of international competition. In September, 1981, it suspended operation of aluminum production at Naoetsu. The smelter was transferred to a new firm capitalized at ¥3 billion, which is trying to develop new products to make up for sluggish aluminum business.

Alumina fiber will become its major product after aluminum mirror materials, solar system and high-purity aluminum.

CSO: 4120/100

SCIENCE AND TECHNOLOGY

BRIEFS

DEVELOPMENT OF FBR FUELS--Aiming at developing fuels for FBR's, the Power Reactor and Nuclear Fuel Corporation (PNC) and the Department of Energy, U.S. Government, have decided to conduct joint Japanese-American research using the American-made high-speed material test reactor "FFTF" (thermal output 400,000 kW) and the highspeed test reactor "EBR-2" (thermal output 62,500 kW). In development of an FBR, PNC has cooperated extensively with the U.S., Britain and France, and based on the FBR cooperation agreement for development, that PNC concluded with the U.S. in 1969, the Corporation's efforts, especially with the U.S., have ranged over wide areas of activity during the past 12 years, including exchanges of information and dispatching of engineers on a long-term stay basis. The objective of the current joint research is to conduct tests that cannot be conducted by using PNC's test reactor "Joyo," such as neutron irradiation tests of fuel assemblies and fuel cladding tubes by using FFTF, and operation tests of damaged fuels by using EBR-2. The share of the cost to be borne by PNC is about ¥3.1 billion. PNC hopes the results gained from the tests will be reflected in the construction of the FBR prototype reactor "Monju" (electrical output 280,000 kW) that is at present on the drawing board. [Text] [Tokyo TECHNOCRAT in English Vol 14 No 9, Sep 81 p 56] [COPYRIGHT: 1981 Fuji Marketing Research Co., Ltd.]

COAL TECHNOLOGY COOPERATION WITH SHELL--The Electric Power Development Co. (EPDC) and Royal Dutch Shell, an oil major, have agreed to cooperate in developing coal utilization technology. Last year, the two firms concluded a cooperative agreement to produce coal-oil-mixture (COM) on a commercial basis, and the current agreement further expands this activity to the entire scope of technical development related to use of coal including (1) combustion technology of coal, such as by fluid-bed boilers, and (2) technology to prevent spontaneous combustion. Shell, the most keenly interested of major oil firms in the development of coal and in techniques for its use, is holding negotiations on the supply of steam coal, in technical cooperation with EPDC that has the most experience with coal-fired power generation in Japan. Last March, the two firms concluded an agreement that covered such matters as (1) feasibility of commercial use of COM, and (2) use of COM in Pan-Pacific areas. Thereafter, the two firms have been probing the feasibility of technical cooperation that covers not only COM but also all aspects of coal utilization technology, and both sides have agreed basically that such cooperation is possible. As for fluid-bed boilers, Shell is expected to extend cooperation in the development of a pilot plant that EPDC has been promoting at its Wakamatsu Thermal Power Station. [Text] [Tokyo TECHNOCRAT in English Vol 14 No 9, Sep 81 p 56] [COPYRIGHT: 1981 Fuji Marketing Research Co., Ltd.]

RADIOACTIVE WASTE REDUCTION--The Tokyo Electric Power Co. is developing new methods to reduce the volume of low-level radioactive waste from nuclear power plants, such as an "acid decomposition process" and "melting using microwaves." The projects are underway in cooperation with nuclear equipment makers, and the company expects that the success of these developments in addition to the existing technology will complete the whole system to deal with low-level nuclear waste. It intends to complete practical tests of these techniques by FY 1983 at the latest for full-scale actual use in the first half of the 1980's. The projects being developed by the Tokyo Electric Power Co. to cut solid waste volume are four as follows: (1) acid decomposition of various incombustible solids, such as used resin and sludge; (2) incineration of used resin and activated carbon; (3) applying microwave heat for melting ash; and (4) volume reduction by plasma are melting. Among them, the acid decomposition process seems most hopeful in practice. It dissolves and carbonizes ion exchange resin or other materials in concentrated sulfuric acid, thereby converting the solids into powder by means of nitric acid. A nuclear power station in the 1000MW range usually discharges low level waste equivalent to more than 3000 drums (200ℓ each) per yearly. With the new reduction techniques, as well as plastics solidification that the company decided earlier to adopt for drum packing, the annual quantity will be lowered to 500 drums or less. [Text] [Tokyo TECHNOCRAT in English Vol 14 No 9, Sep 81 p 58] [COPYRIGHT: 1981 Fuji Marketing Research Co., Ltd.]

CANDU REACTOR DESIGN--The Electric Power Development Company has decided to start conceptual designing for CANDU, a Canadian heavy water reactor, and will seek a budget of more than ¥1 billion out of treasury loans and investments. At the same time, the company will conduct comprehensive evaluation of the overall system on the basis of a technical survey made so far. Hitachi, Ltd. and Toshiba Corporation, which are expected to extrusted with designing have sent engineers to AECL for about one year's training. The introduction of CANDU reactors was rejected by the Japan Atomic Energy Commission in August, 1979, for reasons that the decision is subject to further review if a change in the nuclear power situation is encountered, and that it requires a shift in Japanese policy. The company's intention is to be responsive to any switch in the future by establishing the technical basis for possible CANDU introduction. [Text] [Tokyo TECHNOCRAT in English Vol 14 No 9, Sep 81 p 58] [COPYRIGHT: 1981 Fuji Marketing Research Co., Ltd.]

MITSUBISHI FBR CONTROL RODS--The Mitsubishi Metal Corporation has recently established a complete process for making enriched boron carbide to be employed for nuclear reactor control rods. This will enable domestic production of control rods for fast breeder reactors, which are now dependent on imported materials. Advanced countries in nuclear energy, such as France and the U.S., regard know-how to produce FBR control rod materials as "sensitive technology", and are trying to prevent it spreading abroad. Mitsubishi Metal will shortly start production of enriched boric acid, an intermediate, for light water reactors, as well as for FBR's. The process developed by Mitsubishi first converts natural boron fluoride into an enriched compound (90%) with a solvent by precise distillation, and then into enriched boric acid by means of hydrolysis. The material is reduced with magnesium and carbonated in an electric furnace to form enriched boron carbide powder and then pelleted. [Text] [Tokyo TECHNOCRAT in English Vol 14 No 9, Sep 81 p 58] [COPYRIGHT: 1981 Fuji Marketing Research Co., Ltd.]

CAPTAIN SERVICE EXTENDED--The Ministry of Posts and Telecommunications has started to extend the CAPTAIN service, Character and Pattern Information Network. It intends to include access to external online network services, such as referring bank accounting positions and making seat reservations for airplanes and trains. [Text] [Tokyo TECHNOCRAT in English Vol 14 No 9, Sep 81 p 72] [COPYRIGHT: 1981 Fuji Marketing Research Co., Ltd.]

'ORBIT-1' PROGRAM DEVELOPED--Kokusai Denshin Denwa Co., Ltd. (KDD) has recently developed a program "ORBIT-1," which optimizes the orbit positions of a number of stationary satellites. They have offered it to the International Telecommunication Union (ITU). "ORBIT-1" is a program which enables optimizing the positions of several hundred satellites by adopting an optimization method known as nonlinear programming and a method of "determining the optimal positions of satellites in launching order" referred to as evolutional modelling. It is also provided with such function as to indicate the orbit position of a satellite, when launching the new one, that minimizes the mutual interference between satellites and makes more efficient use of orbits. That is to say, it gives such satellite position that the sum of the orbit lengths of all satellites is minimized within a certain range of a standard value of total interference between each satellite, thereby providing the maximum margin for future demands. KDD says that the program, using the 6/4 GHz frequency band, can cope sufficiently with the situation in ten years time when about 200 satellites may be orbiting. [Text] [Tokyo TECHNOCRAT in English Vol 14 No 9, Sep 81 p 72] [COPYRIGHT: 1981 Fuji Marketing Research Co., Ltd.]

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